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U. S. Nuclear Regulatory Commission
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SUSQUEHANNA STEAM ELECTRIC STATION
PROPOSED AMENDMENT NO. 269 TO UNIT 1 LICENSE NPF-14
AND AMENDMENT NO. 236 TO UNIT 2 LICENSE NPF-22:
DC ELECTRICAL POWER SYSTEMS TECHNICAL
SPECIFICATIONS REWRITE **Docket Nos. 50-387**
PLA-5825 **50-388**

In accordance with the provisions of 10 CFR 50.90, PPL Susquehanna, LLC is submitting a request for amendment to the Technical Specifications for Susquehanna Units 1 and 2.

The purpose of this letter is to propose changes to the Susquehanna Steam Electric Station Units 1 and 2 Technical Specifications. Included are revisions to Sections 3.8.4, 3.8.5, 3.8.6, and Section 5.5. These revisions reflect changes to the DC Electrical Power sections which are essentially a rewrite of those sections consistent with Technical Specification Task Force (TSTF) 360 Revision 1, which was approved by the NRC on December 18, 2000, and has been incorporated into Revision 2 of NUREG-1433, "Standard Technical Specifications, General Electric Plants, BWR/4," issued by the NRC in June 2001.

The enclosure to this letter contains PPL's evaluation of this proposed change. Included are a description of the proposed change, technical analysis of the change, regulatory analysis of the change (No Significant Hazards Consideration and the Applicable Regulatory Requirements), and the environmental considerations associated with the change.

Attachment 1 to this letter contains the applicable pages of the Susquehanna SES Units 1 and 2 Technical Specifications, marked to show the proposed changes (Note that underlined text is added and strike through text is deleted).

Attachment 2 contains the applicable pages of the Susquehanna SES Unit 2 Technical Specifications Bases, similarly marked to show the proposed changes (Provided for Information only).

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There are no regulatory commitments associated with these proposed changes and they have been approved by the Susquehanna SES Plant Operations Review Committee and reviewed by the Susquehanna Review Committee.

PPL plans to implement the proposed changes as soon as practical following NRC approval. Therefore, we request NRC complete its review by June 30, 2005 with Unit 2 changes to be implemented within 60 days of NRC approval and Unit 1 changes to be implemented following the next Unit 1 Refueling and Inspection Outage.

Any questions regarding this request should be directed to Mr. Duane L. Filchner at (610) 774-7819.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 11-9-04

B. T. McKinney

Enclosure: PPL Susquehanna Evaluation of the Proposed Changes

Attachments:

Attachment 1 - Proposed Technical Specification Changes Units 1 and 2, (Mark-ups)
Attachment 2 - Proposed Technical Specification Bases Changes Units 1 and 2, (Mark-ups)

cc: NRC Region I
Mr. A. J. Blamey, NRC Sr. Resident Inspector
Mr. R. V. Guzman, NRC Project Manager
Mr. R. Janati, DEP/BRP

ENCLOSURE TO PLA-005825

PPL SUSQUEHANNA EVALUATION OF PROPOSED CHANGES

UNITS 1 & 2 DC ELECTRICAL POWER SYSTEMS TECHNICAL SPECIFICATIONS REWRITE (TSTF-360)

PPL EVALUATION

Subject: Units 1 & 2 DC ELECTRICAL POWER SYSTEMS TECHNICAL SPECIFICATION REWRITE

1.0 DESCRIPTION

This is a request to amend Operating Licenses NPF-14 and NPF-22 for PPL Susquehanna, LLC (PPL), Susquehanna Steam Electric Station (SSES) Units 1 and 2. It represents proposed revisions to the SSES Technical Specification (TS) 3.8.4 "DC Sources – Operating," 3.8.5 "DC Sources – Shutdown," 3.8.6 "Battery Cell Parameters," and addition of new TS Section 5.5.13 "Battery Monitoring and Maintenance Program." These changes are consistent with TSTF-360, Revision 1, (Reference 1), submitted to the NRC by the Technical Specifications Task Force (TSTF).

2.0 PROPOSED CHANGES

The proposed changes are to TS Sections 3.8.4, 3.8.5, 3.8.6, and 5.5. These changes request new actions with increased completion times for an inoperable battery charger as well as request alternate battery charger testing criteria for Limiting Condition for Operation (LCO) 3.8.4 and LCO 3.8.5. The proposed changes also include the relocation of several Surveillance Requirements (SRs) in TS Section 3.8.4, that perform preventive maintenance on the safety-related batteries, to a licensee-controlled program. It is proposed that TS Table 3.8.6-1, "Battery Cell Parameter Requirements," be relocated to a licensee-controlled program, and specific actions with associated completion times for out-of-limits conditions for battery cell voltage, electrolyte level, and electrolyte temperature be added to TS Section 3.8.6. In addition, specific SRs are being proposed for verification of these parameters.

A new program is being proposed for the maintenance and monitoring of station batteries based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." This program will be described in TS Section 5.5.13, "Battery Monitoring and Maintenance Program." All of the items proposed to be relocated will be contained within this new program to be located in the Technical Requirements Manual (TRM), which is incorporated by reference in the SSES FSAR. This will make all relocated items subject to review under 10 CFR 50.59,

"Changes, Tests and Experiments," to determine if the proposed changes will require prior NRC review and approval, and will require reporting of all changes to the NRC in accordance with 10CFR 50.71(e), "Maintenance of Records, Making of Reports."

As stated above, these proposed changes are consistent with TSTF-360, Revision 1 (Reference 1), submitted to the NRC by the Technical Specifications Task Force (TSTF). TSTF-360, Rev. 1, was approved by the NRC on December 18, 2000 (Reference 2), and has been incorporated into Revision 2 of NUREG-1433, "Standard Technical Specifications, General Electric Plants, BWR/4," issued by the NRC in June 2001, (Reference 3).

The proposed changes are described in detail in Section 3.4 below. They are consistent with submittals by Clinton (Reference 4), Limerick (Reference 5), Dresden (Reference 6), Diablo Canyon (Reference 7), and Comanche Peak (Reference 8) which have received NRC approval. In addition, the issues identified in the Oyster Creek Request for Additional Information (Reference 9), have also been addressed. The marked-up TS pages are provided in Attachment 1 to this submittal. The associated marked-up TS Bases pages are provided for information only in Attachment 2 to this submittal.

3.0 BACKGROUND

3.1 Current Regulatory Requirements

SSES FSAR Section 8.3.2.2.1, Compliance with General Design Criteria, Regulatory Guides, and IEEE Standards, provides detailed discussion of SSES compliance with the applicable regulatory requirements and guidance. The proposed TS amendment does not alter the design or function of any DC electrical power subsystem, it does not result in any change in the qualification of any component, and it does not result in the reclassification of any component's status in the areas of shared, safety related, independent, redundant, and physically or electrically separated.

This amendment will result in changes to SSES compliance with Regulatory Guide 1.93 in that inoperable battery chargers will be justified for up to a 7-day restoration time. Additionally, the existing SSES commitments to IEEE Standard 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," reflect commitment to the 1995 edition of IEEE Standard 450.

3.2 Description of the Current Requirements

TS Section 3.8.4, "DC Sources – Operating," requires that the Class 1E 125 VDC and 250 VDC electrical power subsystems listed in Table 3.8.4-1 shall be operable in Modes 1, 2, and 3. Refer to FSAR chapter 8.3.2 "DC Power Systems" for a detailed description of the SSES Class 1E 125 VDC and 250 VDC electrical power subsystems.

Condition A states that in the event that a DC electrical power subsystem listed in the table becomes inoperable, the inoperable DC electrical power subsystem must be restored back to operable status within 2 hours.

Condition B states that if the inoperable DC electrical power subsystem cannot be restored within 2 hours, the plant must be in Mode 3 within 12 hours and then be in Mode 4 within 36 hours.

Condition C requires verification (within 2 hours) that all ESW valves associated with Diesel Generator E (D/G E) are closed when the associated DC electrical subsystem is inoperable and the D/G E is not aligned to the Class 1E distribution system.

Condition D states that when the D/G E is aligned and its associated DC electrical subsystem is inoperable, the D/G E must be declared inoperable within 2 hours.

Condition E only applies to Unit 2 TS 3.8.4 and it requires that with one or more Unit 1 125 VDC electrical power subsystems inoperable, the associated Unit 1 and common loads are required to be transferred to the corresponding Unit 2 DC electrical power subsystem within 2 hours. Further, the transferred Unit 1 and common loads are required to be restored to the corresponding Unit 1 DC electrical power subsystem within 72 hours after the Unit 1 subsystem is restored to OPERABLE.

Note: The Unit 1 125 VDC loads and the 125 VDC loads common to both units, e.g., Emergency Service Water (ESW) and D/G controls, etc. are normally supplied by the Unit 1 125 VDC DC electrical subsystems. These common load circuits can be transferred to the Unit 2 125 VDC electrical power subsystems to assure the common load availability for Unit 2.

Condition F requires that the associated common loads be declared inoperable immediately if the required actions of Condition E are not met.

TS Section 3.8.4 has several Surveillance Requirements (SR) which demonstrate operability. The required SRs are as follows:

- SR 3.8.4.1 requires that the 125 VDC battery terminal voltage be verified to be greater than or equal to 129 Volts (V) and that the 250 VDC battery terminal voltage be verified to be greater than or equal to 258 V every 7 days while the batteries are maintained on a float charge unless the battery is on equalize charge or has been on equalize charge at any time during the previous 24 hours, in which case the surveillance frequency is 14 days.

- SR 3.8.4.2 requires verification that no visible corrosion is present at each battery cell terminal and connector or that battery cell terminal and connection resistance is less than or equal to 50E-6 ohm, or less than or equal to 100.0 E-6 ohms at each cell terminal or connector with the calculated average resistance for the battery bank less than or equal to 50.0E-6 ohms. Verification of these values must be performed every 92 days.

- SR 3.8.4.3 requires that battery cells, cell plates, and racks are verified to show no visual indication of physical damage or abnormal deterioration every 18 months.

- SR 3.8.4.4 requires removal of all visible corrosion and verification that the battery cell-to-cell and terminal connections are coated with anti-corrosion material every 18 months.

- SR 3.8.4.5 requires verification, every 18 months, of battery cell connection resistance to be less than or equal to 100E-6 ohms for any single connection and the calculated average resistance for the battery bank is less than or equal to 50.0 E-6 ohms.

- SR 3.8.4.6 requires verification, every 24 months, that each required battery charger supplies its associated battery at the following rates for greater than 4 hours:

  - Greater than or equal to 100 amps for a 125 VDC battery at greater than or equal to 127.8 V;

  - Greater than or equal to 300 amps for a 250 VDC battery at greater than or equal to 255.6 V;

  - Greater than or equal to 200 amps for the 125 VDC Diesel Generator E battery at greater than or equal to 127.8 V.

- SR 3.8.4.7 requires verification of battery capacity to be adequate to supply, and maintain in operable status, the required emergency loads for the design duty cycle by performance of a battery service test every 24 months. A note is

provided which allows performance of the modified performance discharge test in SR 3.8.4.8 in lieu of the service test in SR 3.8.4.7 once per 60 months.

- SR 3.8.4.8 requires verification that battery capacity is greater than or equal to 80% of the manufacturer's rating when the battery is subjected to a performance discharge test or a modified performance discharge test. This test must be conducted every 60 months and every 12 months when the battery shows degradation or has reached 85% of expected service life with capacity less than 100% of the manufacturer's rating, and every 24 months when the battery has reached 85% or the expected service life with capacity greater than or equal to 100% of the manufacturer's rating.

- SR 3.8.4.9 (Unit 2 only) requires the SR's for the Unit 1 specification 3.8.4 to be applicable. When Unit 1 is in Mode 4 or 5 or when moving irradiated fuel assemblies in the secondary containment, the Note to Unit 1 SR 3.8.5.1 is applicable.

TS Section 3.8.5, "DC Sources – Shutdown," requires the DC electrical power subsystems listed in Table 3.8.4-1 to be operable when in Modes 4 and 5, and during the movement of irradiated fuel assemblies in the secondary containment to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems – Shutdown."

Condition A states that in the event that one or more required DC electrical power subsystems listed in the table becomes inoperable, the inoperable DC electrical power subsystem must be declared inoperable immediately or core alterations must be suspended immediately, and movement of irradiated fuel in secondary containment must be suspended immediately, and actions must be initiated immediately to suspend operations having the potential to drain the reactor vessel, and action must be initiated immediately to restore the required DC electrical power subsystems back to operable status. This condition is modified by a note indicating that the condition does not apply to the DG E electrical power subsystem.

Condition B states that if the D/G E DC electrical power subsystem becomes inoperable while DG E is not aligned to the Class 1E distribution system, all ESW valves associated with D/G E must be verified closed within 2 hours.

Condition C requires that if the D/G E DC electrical power subsystem becomes inoperable while D/G E is aligned to the Class 1E distribution system, D/G E must be declared inoperable within 2 hours.

For Unit 2 TS 3.8.5 only, Condition D states that if one or more required Unit 1 DC electrical power subsystems is inoperable, the affected required feature(s) is/are declared inoperable immediately. This action is followed by an OR statement that contains requirements to immediately suspend core alterations and movement of irradiated fuel assemblies in the secondary containment and initiate action to suspend operations with a potential for draining the vessel and initiate action to restore required DC electrical subsystem power to OPERABLE status.

These actions are followed by an OR statement that contains the requirement to immediately initiate action to transfer the Unit 1 and common loads to the corresponding Unit 2 DC electrical power subsystem and, within 72 hours (after the Unit 1 DC electrical power subsystem is restored to OPERABLE status), restore the Unit 1 and common loads to the corresponding Unit 1 electrical power subsystems or declare the associated Unit 1 and common loads inoperable. This condition is modified by a note, stating that it does not apply to the D/G E electrical power subsystem.

The SRs for TS Section 3.8.4 are applicable for demonstrating operability requirements for TS Section 3.8.5.

<u>TS Section 3.8.6, "Battery Cell Parameters,"</u> requires that the battery cell parameters for the Class 1E 250 V batteries and the Class 1E 125 V batteries shall be within limits when the associated DC electrical power subsystems are required to be operable.

Condition A contains the requirement that if one or more batteries with one or more battery cell parameters are not within Category A or B limits, verification of pilot cell electrolyte level and float voltage to Category C limits must be made within 1 hour and verification that battery cell parameters meet Category C limits within 24 hours and once per 7 days thereafter, and battery cell parameters must be restored to Category A and B limits within 31 days.

Condition B requires an immediate declaration of battery inoperability if the required action and associated completion time of Condition A is not met, or one or more batteries with average electrolyte temperature of the representative cells are not within limits, or one or more batteries with one or more battery cell parameters are not within Category C values.

- <u>Category A Limits</u>: This category defines the normal parameter limits for each designated pilot cell. The electrolyte level must be greater than the minimum level indication mark, and less than or equal to ¼ inch above the maximum level indication mark. The float voltage must be greater than or equal to

2.13 V. The specific gravity of the pilot cell must be greater than or equal to 1.200.

- Category B Limits: This category defines the normal parameter limits for each connected battery cell. The electrolyte level must be greater than the minimum level indication mark, and less than or equal to ¼ inch above the maximum level indication mark. The float voltage must be greater than or equal to 2.13 V. The specific gravity of the measured cell must be greater than or equal to 1.195 and the average specific gravity of all connected cells must be greater than or equal to 1.205.

- Category C Limits: This category defines the minimum acceptable parameter limits for each connected cell. The electrolyte level must be above the top of the plates and not overflowing. The float voltage must be greater than 2.07 V. The specific gravity of the measured cell must be not more than 0.020 below the average of all connected cells and the average specific gravity of all connected cells must be greater than or equal to 1.195.

TS Section 3.8.6 has three SRs to demonstrate operability of the associated batteries. The required SRs are as follows:

- SR 3.8.6.1 requires that the battery cell parameters be verified to meet Category A limits every 7 days.

- SR 3.8.6.2 requires that the battery cell parameters be verified to meet Category B limits every 92 days, and once within 24 hours after a battery discharge of less than 110 V for the 125 V batteries and less than 220 V for the 250 V batteries, and once within 24 hours after a battery overcharge that is greater than 150 V for the 125 V batteries and greater than 300 V for the 250 V batteries.

- SR 3.8.6.3 requires the verification that the average electrolyte temperature of representative cells is greater than or equal to 60°F every 92 days.

3.3 Description of the Current Systems

Each unit has a 250 VDC electrical power system which consists of two separate and independent Class 1E 250 VDC subsystems designated as Division I and Division II. Each 250 VDC division contains a battery bank of 120 lead calcium cells having a nominal terminal voltage of 250 volts, a 250 VDC load center, and 250 VDC motor control centers to distribute power to connected Class 1E and non-Class 1E loads. In addition, each 250 VDC Division I subsystem has two full

capacity battery chargers connected to the loads. The 250 VDC Division II subsystem has only one full capacity battery charger connected to the loads.

The 250 VDC Division I subsystems were originally designed with two half-capacity battery chargers operating in parallel to equally share the connected loads. Recent analysis has determined that only one battery charger is necessary to supply these loads and it has the capacity to recharge the batteries within 24 hours. Therefore, credit is taken in this proposed change for these chargers as full capacity chargers. As such, either 250 VDC Division I subsystem battery charger is capable of performing the required design function and the other Division I battery charger is considered to be an installed spare charger.

Only one 250 VDC battery charger was required to supply the loads in the original design of the 250 VDC Division II electrical power subsystems. Therefore, only one charger was provided in the system design, i.e., the 250 VDC Division II electrical power subsystem on each unit does not have a spare battery charger installed.

The 250 VDC electrical power subsystems on each unit supply the power required for larger DC loads such as motor driven pumps and valves, inverters for plant computer and vital 120V AC power supplies.

During normal operation, the 250 VDC loads receive power from the 250 VDC battery chargers with the batteries floating on the system. A loss of the AC power supply to the battery chargers results in the 250 VDC loads receiving power directly from the Class 1E 250 VDC batteries. No operator action is required for this transfer because the battery banks are connected in parallel to the charger and they automatically assume the loads.

Each unit has a 125 VDC electrical power system which consists of four separate and independent Class 1E subsystems designated as subsystems A, B, C, and D. Each of these 125 VDC electrical power subsystems contains a battery bank of 60 lead calcium cells having a nominal terminal voltage of 125 volts, a 125 VDC battery charger, a 125 VDC load center, and 125 VDC distribution panels to distribute power to connected Class 1E and non-Class 1E loads. Each 125 VDC electrical power subsystem provides the control power for its associated Class 1E AC power load group (designated as A, B, C, D) consisting of 4.16 kV switchgear, 480V load centers, and a standby diesel generator as discussed in FSAR Section 8.3.1. These 125 VDC subsystems also provide DC power to the engineered safety feature (ESF) valve actuation, diesel generator auxiliaries and controls, and plant alarm and indication circuits.

The "A" and "C" 125 VDC load group subsystems together are considered to be the 125 VDC Division I subsystem. Similarly, the "B" and "D" 125 VDC load group subsystems together are considered to be the 125 VDC Division II subsystem.

During normal operation, the Unit 1 and common 125 VDC loads receive power from the Unit 1 125 VDC battery chargers with the batteries floating on the system. The Unit 2 125 VDC loads are powered from the Unit 2 125 VDC battery chargers with the batteries floating on the system. The common 125 VDC loads, normally powered from the Unit 1 125 VDC electric power subsystems, can be transferred to the Unit 2 125 VDC electric power subsystems when necessary. A loss of the AC power supply to the battery chargers results in the 125 VDC loads receiving power directly from the Class 1E 125 VDC batteries. No operator action is required for this transfer because the battery banks are connected in parallel to the charger and they automatically assume the loads.

Additionally, a Class 1E 125 VDC battery is installed as a dedicated DC power supply for only the D/G E Class 1E DC loads and the four motor operated valves used to align Emergency Service Water (ESW) to D/G E. The D/G E 125 VDC electrical power subsystem consists of a separate and independent Class 1E subsystem. This 125 VDC electrical power subsystem contains a battery bank of 60 lead calcium cells having a nominal terminal voltage of 125 volts, a 125 VDC battery charger, a 125 VDC motor control center, and a 125 VDC distribution panels to distribute power to connected Class 1E loads.

Each 250 VDC or 125 VDC battery has adequate storage capacity to supply power to the required loads continuously for at least 4 hours as discussed in the FSAR, Section 8.3.2, "DC Power Systems."

The battery cells for a DC electrical power subsystem are sized such that the required battery capacity exists at 80% of the battery rating. The minimum voltage design limit is 210 V for the 250 VDC batteries and 105 V for the 125 VDC batteries.

Each battery charger of the 250 VDC and the 125 VDC electrical power subsystems has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger has sufficient capacity to restore the battery bank from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads.

The 250 VDC and the 125 VDC electrical power subsystems are required to be operable to ensure required power is available to shutdown the reactor and

maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated design basis accident (DBA). Loss of any single DC electrical power subsystem does not prevent the minimum safety function from being performed.

Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an AOO or a postulated DBA. Electrolyte limits are conservatively established, thus allowing continued DC electrical system function even with limits not met.

3.4 Description of the Proposed Changes

LCO 3.8.4:

Change 1: Two new conditions are added to LCO 3.8.4. These conditions with their associated required actions will provide compensatory actions for a specific component failure in a DC electric power subsystem (e.g. battery charger and batteries).

A) The new Condition A addresses the condition where a 250 VDC Division II or a 125 VDC subsystem battery charger becomes inoperable. These DC electrical subsystems have only one battery charger as indicated on Table 3.8.4-1. This new Condition A also addresses the condition where both 250 VDC Division I battery chargers are inoperable.

Since only one 250 VDC Division I battery charger is required to supply the 250 VDC loads and recharge the battery in 24 hours, both Division I chargers would have to be inoperable before Condition A applies. Table 3.8.4-1 has been revised by adding an "or" to the 250 VDC Division I list of equipment. Required Actions are proposed that provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to operable status in a reasonable time. Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within two (2) hours. Required Action A.2 requires verification that the battery float current be less than or equal to 2 amps once per 12 hours. The final required action, A.3, limits the restoration time for the inoperable battery charger to 7 days. Also, a note is added to Condition A which states that Conditions A, B, and C are not applicable to the D/G E DC electrical power subsystem.

Note that the present designs of the 250 VDC Division II electrical power subsystems and the 125 VDC electrical power subsystems do not include any

connected spare chargers nor do they have provisions to connect a spare charger in order to maintain float voltage and charging current in the event of an inoperable charger.

Only the 250 VDC Division I electrical power subsystem on each unit has a full capacity spare charger installed that could be considered a spare.

The proposed revision to TS 3.8.4 establishes ACTIONS and COMPLETION TIMES for an inoperable battery charger. It is acceptable to implement this change even though spare battery chargers are not yet installed on the 250 VDC Division II electrical power subsystem or the 125 VDC electrical power subsystems. The basis for acceptability is that for an inoperable charger CONDITION the inability to meet the REQUIRED ACTION COMPLETION TIME would result in a 2 hour LCO. This TS COMPLETION TIME is identical to the current TS 3.8.4 COMPLETION TIME and is therefore no less conservative.

B) The new Condition B addresses the condition where a 250 VDC or a 125 VDC battery bank becomes inoperable. The associated required action is to restore the inoperable battery to operable status within 2 hours.

C) The current Condition A is renamed Condition C and has been clarified by adding the stipulation "for reasons other than Condition A or B."

D) The current Condition B is renamed Condition D and additional reference is made to Conditions B or C.

E) The current Condition C is renamed Condition E.

F) The current Condition D is renamed Condition F.

<u>For Unit 2 only</u>:

G) The current Condition E is renamed Condition G.

H). The current Condition F is renamed Condition H.

<u>**Change 2**</u>: Revise SR 3.8.4.1 to state "Verify battery terminal voltages for the 125 V batteries and for the 250 V batteries are greater than or equal to the minimum established float voltage," and delete references to the values of ≥129 V and ≥258 V on a float charge. Also delete the note that states "The 7 day frequency is not applicable if the battery is on equalize charge or has been on

equalize charge at any time during the previous 24 hours," and delete the corresponding "and 14 days" frequency associated with the note.

<u>Change 3</u>: Delete SR 3.8.4.2, SR 3.8.4.3, SR 3.8.4.4, and SR 3.8.4.5 from the SSES TS and relocate these tests to a licensee-controlled program (See Change 15). This will require renumbering SR 3.8.4.6 as SR 3.8.4.2 and SR 3.8.4.7 as SR 3.8.4.3.

<u>Change 4</u>: Provide alternative testing criteria to current SR 3.8.4.6 (i.e. revised SR 3.8.4.2) for battery charger testing.

<u>Change 5</u>: Rename current SR 3.8.4.7 to SR 3.8.4.3 and provide clarification to the note for this SR relative to revised SR references and credit which may be taken for unplanned events that satisfy the SR.

<u>Change 6</u>: Relocate SR 3.8.4.8 to SR 3.8.6.6. The note for this relocated SR will be modified to state that credit may be taken for unplanned events that satisfy the SR.

<u>LCO 3.8.5</u>:

<u>Change 7</u>: A new condition is added to LCO 3.8.5. This new Condition A, with its associated required actions, will provide compensatory actions for battery charger failures in the 125 VDC or 250 VDC electrical power subsystems during shutdown conditions, provided that the redundant 125 VDC or 250 VDC electrical power subsystem is operable. Also, a note is added to Condition A which states that Conditions A and B are not applicable to the DG E DC electrical power subsystem.

<u>Change 8</u>: Existing Condition A will be renamed as Condition B and modified by adding the stipulation that "for reasons other than Condition A."

<u>Change 9</u>: Existing Conditions B and C will be renamed as Conditions C and D respectively. For Unit 2 only, existing Condition D will be renamed Condition E.

<u>Change 10</u>: SR 3.8.5.1 is revised to eliminate reference to SR's 3.8.4.4, 3.8.4.5, 3.8.4.6, 3.8.4.7, and 3.8.4.8 which were removed by revision to LCO 3.8.4. Also, the note for SR 3.8.5.1 is revised to provide proper reference to SR's 3.8.4.2, and 3.8.4.3.

LCO 3.8.6:

Change 11: The title of TS Section 3.8.6 is revised to "Battery Parameters" and the LCO is revised to read, "Battery parameters for the Class 1E 250 V batteries and Class 1E 125 V batteries shall be within limits."

Change 12: Relocate TS Table 3.8.6-1 battery cell parameters and Condition A, to the proposed Battery Monitoring and Maintenance Program described in TS Section 5.5.13. This table provides the required actions to be taken when battery cell parameters are found to be outside TS Table 3.8.6-1 values.

Change 13: Condition A is replaced with five new conditions. These conditions, with their associated required actions, will provide compensatory actions for a specific abnormal battery condition. The conditions are:

A. Condition A addresses the condition where a battery bank in a specific 125 VDC electric power subsystem or 250 VDC electric power subsystem has one or more battery cells with a float voltage less than 2.07 V.

B. Condition B addresses the condition where a battery bank is found with a float current of greater than 2 amps.

C. Condition C addresses the condition where a battery bank is found with the electrolyte level in one or more cells to be less than the minimum established design limits.

D. Condition D addresses the condition where a battery bank is found with a pilot cell electrolyte temperature less than the minimum established design limits.

E. Condition E addresses the condition where one or more batteries in redundant 125 VDC or redundant 250 VDC subsystems are found with battery parameters not within established design limits.

F. Current Condition B will be renamed as Condition F. The current Condition B consists of three separate entry conditions. As part of this proposed change, the last two entry conditions, (one or more batteries found with an average electrolyte temperature of the representative cell not within limits, and one or more batteries found with battery cell parameters not within Category C values) will be deleted. The deleted conditions will be replaced with a new condition requiring entry when one battery in a 125 VDC or a 250 VDC subsystem is found with one or more battery cells with a float voltage of less than 2.07 V and float current greater than 2 amps.

Change 14: Current SR 3.8.6.1, SR 3.8.6.2, and SR 3.8.6.3 will be deleted and will be replaced with the following SRs that are required to support this change. The Note has been removed from the SR frequency column regarding the 7 day Frequency requirement for these SRs and the 14 day Frequency requirement for a battery that has been on equalize charge.

A. SR 3.8.6.1 will require verification of each battery float current to be less than or equal to 2 amps every 7 days.

B. SR 3.8.6.2 will require verification of each battery pilot cell to be greater than or equal to 2.07 V every 31 days.

C. SR 3.8.6.3 will require verification of each connected cell electrolyte level to be greater than or equal to the minimum established design limits every 31 days.

D. SR 3.8.6.4 will require verification of each battery pilot cell temperature to be greater than or equal to the minimum established design limits every 31 days.

E. SR 3.8.6.5 will require verification of each connected battery cell voltage to be greater than or equal to 2.07 V every 92 days.

F. SR 3.8.6.6. which is relocated from current SR 3.8.4.8 as previously described.

Change 15: A new program will be added to TS Section 5.5, "Programs and Manuals." New TS page 5.0-18A is added for new TS Section 5.5.13, "Battery Monitoring and Maintenance Program," to provide for restoration and maintenance actions for station batteries that will be based on the recommendations of IEEE Standard 450-1995.

4.0 TECHNICAL SAFETY ANALYSIS OF THE PROPOSED CHANGES

Change 1 and Change 7: Addition of new Conditions to LCO 3.8.4 and LCO 3.8.5

These changes add specific actions and increased completion times for an inoperable battery charger. The current technical specifications limit restoration time for an inoperable battery charger to the same time as for an inoperable battery or a completely de-energized DC distribution subsystem, i.e. 2 hours. The primary role of the battery charger is in support of maintaining operability of its associated battery. This is accomplished by the charger being of sufficient size to carry the normal steady state DC loads, with sufficient additional capacity to maintain the battery fully charged. The current 2 hour restoration time is based on Regulatory

Guide 1.93, "Availability of Electric Power Sources," and has been applied equally to a minimal reduction in battery charger capacity.

These changes apply a more reasonable restoration time for an inoperable battery charger, while focusing efforts on retaining battery capabilities, and retaining the capacity of the battery charger. The changes will also allow the use of a spare 125 VDC or 250 VDC battery charger, when installed, that is capable of being connected to a 125 VDC electrical power subsystem or 250 VDC electrical power subsystem in the event of an inoperable charger, or in the event of performing online maintenance or testing of a charger. However, the LCO maintains the 2 hour restoration time for a DC distribution system that does not have an operating battery charger connected to maintain battery float voltage and charging current within specified limits.

The actions associated with an inoperable 125 VDC or 250 VDC battery charger provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to operable status in a reasonable time. The first Required Action is to restore the battery terminal voltage to greater than or equal to the battery minimum established float voltage within 2 hours. This time period allows for restoring the inoperable battery charger, or for an alternate means of providing the battery charger function by use of a spare battery charger. Restoring the battery terminal voltage to a value greater than or equal to the minimum established float voltage will ensure that the battery can be restored to its fully charged condition within 12 hours, and that the battery can be restored from any discharge that may have occurred due to battery charger inoperability.

Required Action A.2 assures that the battery is in a fully charged condition by verifying the battery float current is less than or equal to 2 amps once per 12 hours. This float current value provides positive indication that if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged.

Required Action A.3 provides 7 days to restore the inoperable battery charger to operable status. This action is required if an alternate means of restoring the battery terminal voltage has been used. The 7-day completion time represents a reasonable amount of time to effect repairs.

Since the 250 VDC Division I electrical power subsystem on each unit contains two installed full capacity battery chargers, the Actions of Condition A are not required unless both chargers are inoperable. Therefore, a single inoperable 250 VDC Division I electrical power subsystem battery charger does not require any ACTION or COMPLETION TIME per the TS.

Condition B was added to address the condition where a 125 VDC or 250 VDC battery bank is declared inoperable. With a battery bank inoperable, the affected DC bus is being supplied by the connected operable battery charger. Any event that results in a loss of the AC bus supporting the battery charger will also result in a loss of DC power to that 125 VDC electrical power subsystem or 250 VDC electrical power subsystem. Recovery of the AC bus, especially if it is due to a loss of offsite power, could be affected because many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed, and diesel generator output circuit breakers, etc) rely upon the 125 VDC battery banks. The 2 hour limit allows sufficient time to effect restoration of an inoperable battery bank given that the majority of the conditions that lead to battery inoperability (e.g., loss of battery charger or battery cell voltages less than 2.07 V) are identified in TS Sections 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

Change 2: Removal of specific value for the minimum established float voltage.

The specific limiting values for the minimum operating battery charging float voltages in SR 3.4.8.1 will be relocated to the TS Bases. Changes to the TS Bases are under the control of 10 CFR 50.59, "Changes, Tests, and Experiments." The TS will require the battery charger to supply battery terminal voltage "greater than or equal to the minimum established float voltage." The battery manufacturer establishes this voltage to provide the optimum charge on the battery. This voltage will maintain the battery plates in a condition that supports maintaining the battery grid life. As such, the "minimum established float voltage" values can be adequately controlled outside of the Technical Specifications. Additionally, the surveillance to verify battery terminal voltages is required every 7 days. Therefore the note regarding surveillance frequency and the 14-day surveillance frequency requirement are no longer necessary and can be removed.

Change 3: Relocation of preventive maintenance SRs to Licensee – Controlled Programs

In accordance with SR 3.0.1, when any SR is not met, the LCO is not met. This is based on the premise that SRs represent the minimum acceptable requirements for Operability of the required equipment. However, for SR 3.8.4.2, SR 3.8.4.3, SR 3.8.4.4, and SR 3.8.4.5, failure to meet the SR does not necessarily mean that the equipment is not capable of performing its safety function, and the corrective action is generally a routine or preventive maintenance-type activity. For example, the Bases for SR 3.8.4.4 identifies removal of visible corrosion and tightening of terminal connections as a preventive maintenance activity. SR 3.8.4.3 requires the visible inspection for physical damage or deterioration that could potentially degrade battery performance. This is not required for the battery to perform its

safety function, rather it reflects ongoing preventive maintenance activities. These activities are inappropriate for SRs and are generally controlled more effectively in the maintenance programs for batteries. With regard to the resistance verifications of SR 3.8.4.2 and SR 3.8.4.5, the values are nominal values and represent values at which some action should be taken, not necessarily when the operability of the battery is in question. The safety analyses do not assume a specific battery resistance value, but typically assume the batteries will supply adequate power. Therefore, the key issue is the overall battery resistance. Between surveillances, the resistance of each battery cell connection varies independently from all the others. Some of these connection resistances may be higher or lower than others, and the battery may still be able to perform its function and should not be considered inoperable solely because one connector's resistance is high. Overall resistance is a direct impact on operability and is adequately determined as acceptable through completion of the battery service and discharge tests. Therefore, these activities are more appropriately controlled under the maintenance program for batteries. Since these surveillances are recommended by IEEE Standard 450-1995, they will be addressed by the new Battery Monitoring and Maintenance Program described in the proposed TS Section 5.5.13 which is discussed below under Change 15.

Change 4: Provide alternate testing criteria for battery charger testing.

Current SR 3.8.4.6, which is being renamed as SR 3.8.4.2, requires specific parameters for battery charger performance testing. This test is intended to confirm the charger design capacity. Alternate acceptance criteria are proposed that would allow an actual in service demonstration that the charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design bases event discharge state. This accomplishes the objective of the existing test and allows for normal in-place demonstration of the charger capability thereby minimizing the time when the charger would be disconnected from the DC bus.

Change 5: Revision of SR 3.8.4.7.

Current SR 3.8.4.7 is renamed to be SR 3.8.4.3 due to the elimination of SR's 3.8.4.2, 3.8.4.3, 3.8.4.4, 3.8.4.5 and the renaming of 3.8.4.6 to 3.8.4.2 discussed in Change 4 above. This is an editorial change. Additionally, the Note in this surveillance is clarified to allow credit to be taken for the surveillance, due to unplanned events, to satisfy the new SR 3.8.4.3.

Change 6: Relocate SR 3.8.4.8 to SR 3.8.6.6. The note for this relocated SR will be modified to state that credit may be taken for unplanned events that satisfy the SR. Relocation of this SR is considered editorial in that it demonstrates the operability of the battery and is therefore proposed to be included in TS Section 3.8.6 related to battery operability.

Change 8: This is an editorial change that resulted from the renaming of existing Condition A as new Condition B and adding the stipulation "for reasons other than Condition A."

Change 9: This is an editorial change that was the result of renaming existing Conditions B and C as new Conditions C and D.

Change 10: This is an editorial change to SR 3.8.5.1 in that it eliminated reference to SR's 3.8.4.4, 3.8.4.5, 3.8.4.6, 3.8.4.7, and 3.8.4.8 which were removed by revision to 3.8.4 discussed in Change 3 above. The revision to the note for SR 3.8.5.1 is necessary to provide proper reference to newly designated SR's 3.8.4.2 and 3.8.4.3.

Change 11: Delete reference to "Cell" in LCO 3.8.6.

This is an editorial change. This LCO is intended to require and define the operability requirements of the Class 1E 250 VDC and Class 1E 125 VDC batteries, and are not limited to Battery Cell Parameters or performance.

Change 12: Relocate TS Table 3.8.6-1 to a licensee-controlled program.

TS Table 3.8.6-1 contains various levels (i.e., Categories) of limitations on battery cell voltage, electrolyte level, and specific gravity parameters.

The Category A and B limits reflect nominal fully charged battery parameter values. Significant margin above that required for declaration of an operable battery is provided in these values. These Category A and B values represent appropriate monitoring levels and an appropriate preventive maintenance level of long term battery quality and extended battery life. These values do not reflect the 10 CFR 50.36, "Technical Specifications," criteria for LCOs of "the lowest functional capability or performance levels of equipment required for the safe operation of the facility."

Category C defines the limits for each connected cell. These values, although reduced, provide assurance that sufficient capacity exists to perform the intended function and maintain a margin of safety. When any battery parameter is outside

the Category C limits, the assurance of sufficient capacity no longer exists and the battery must be declared inoperable.

It is proposed that these parameter values and the actions associated with restoration of these values be relocated to a licensee-controlled program that is under the control of 10 CFR 50.59. This licensee-controlled program is discussed in Change 15 below.

Change 13: Addition of specific actions to LCO 3.8.6 replacing the existing Condition A actions and increased Completion Times for out-of-limit conditions for batteries and the associated SRs.

Specific Required Actions are proposed for parameters that have a unique impact on the battery and its continued operability. These proposed changes provide specific Required Actions and increased Completion Times for out-of-limit conditions for cell voltage, electrolyte level, and electrolyte temperature. These allowed times recognize the margins available, the minimal impact on the battery capacity and the capability to perform its intended function, and the likelihood of effecting restoration in a timely fashion, thus avoiding an unnecessary plant shutdown. In addition, SRs are proposed to verify that the batteries are maintained within the established limitations.

The bases for the specific actions are as follows:

A. Condition A addresses a condition where a specific battery has one or more battery cells with a float voltage less than 2.07 V. If a battery cell is found to be less than 2.07 V, the battery cell must be considered degraded. Within 2 hours, verification of the required battery charger operability is made by monitoring the battery terminal voltage (i.e., performance of SR 3.8.4.1), and determining the overall battery state of charge by monitoring the battery float charge current (i.e., performance of SR 3.8.6.1). These actions assure that there is sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells in one or more batteries being less than 2.07 V, and continued operation is permitted for a limited period up to 24 hours. This is considered a reasonable time to effect restoration of the out-of-limit condition.

B. Condition B addresses a condition where a battery is found with a float current greater than 2 amps, which indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours, verification of the required battery charger operability is made by monitoring the battery terminal voltage

(i.e., performance of SR 3.8.4.1). If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. If the battery charger is found to be inoperable, LCO 3.8.4 Condition A would be entered. If the battery charger is operating in the current limit mode after 2 hours, that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions.

C. Condition C addresses a condition where a battery is found with the electrolyte level in one or more cells to be less than the minimum established design limits. With the electrolyte level in one or more cells found above the top of the battery plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely based on electrolyte level. Within 31 days, the minimum established design limits for electrolyte level must be restored.

   With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 restore the level and ensure that the cause of the loss of electrolyte level is not due to a leak in the battery casing. These actions are only required if the level in the battery is found below the minimum established level limit.

D. Condition D addresses the condition where a battery is found with a pilot cell electrolyte temperature less than the minimum established design limits. Low electrolyte temperature limits the current and power available from the battery. However, since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended functions. Therefore, the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met, and the 12 hours provides a reasonable time to restore the temperature within established limits.

E. Condition E addresses the condition where one or more batteries in redundant 125 VDC or redundant 250 VDC subsystems are found with battery parameters not within established design limits. Given this condition, there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function. Since redundant batteries are involved, this potential could result in a total loss of function on multiple systems that rely upon the batteries.

F. If the Required Actions and associated Completion Times of Conditions A, B, C, D, or E are not met, or if there are one or more battery cells with float voltage less than 2.07 V, the battery must be declared inoperable immediately.

If float voltage is satisfactory and there are no cells less than 2.07 V, there is assurance that within 12 hours the battery will be restored to its fully charged condition from any discharge that might have occurred due to a temporary loss of the battery charger.

Change 14: Current SR 3.8.6.1, SR 3.8.6.2, and SR 3.8.6.3 will be deleted and will be replaced with the following SR's:

A. SR 3.8.6.1 will require verification that the float current for each battery is less than or equal to 2 amps every 7 days. This is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous small amount of current, i.e. less than 2 amps, required to overcome the internal losses of a battery to maintain the battery in a charged state. The float current requirements are based on the float current indicative of a charged battery. The use of float current to determine the state of charge of the battery and the 7-day frequency for performance of this verification is consistent with IEEE Standard 450-1995.

B. SR 3.8.6.2 and SR 3.8.6.5 verify that the float voltage of either pilot cells and all connected cells are equal to or greater than the short term absolute minimum voltage of 2.07 V. this voltage level represents the point where battery operability is in question. Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to a minimum established float voltage, which is established and controlled in accordance with the proposed Battery Monitoring and Maintenance Program provided in TS Section 5.5.13. The Battery Monitoring and Maintenance Program will provide necessary actions if the battery float voltage is found to be less than the minimum established float voltage but greater than the short term absolute minimum voltage of 2.07 V. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE Standard 450-1995.

C. SR 3.8.6.3 verifies that the connected cell electrolyte level of each battery is greater than or equal to the minimum established design limits established in the proposed Battery Monitoring and Maintenance Program provided in TS Section 5.5.13. Operation of the batteries at electrolyte levels greater than the minimum established design limit ensures that the battery plates do not suffer physical damage and continue to maintain adequate electron transfer capability. The Frequency of every 31 days is consistent with IEEE Standard 450-1995.

D. SR 3.8.6.4 verifies the temperature of each battery pilot cell to be greater than or equal to the minimum established design limits established in the proposed Battery Monitoring and Maintenance Program provided in TS Section 5.5.13.

Maintaining the electrolyte temperature above this level ensures that the battery can provide the required current and voltage to meet the design requirements, since temperatures that are lower than assumed in the battery sizing calculations act to inhibit or reduce the overall battery capacity. The Frequency of every 31 days is consistent with IEEE Standard 450-1995.

Change 15: Addition of licensee-controlled program for maintenance and monitoring of batteries.

This program will be based on the recommendations of IEEE Standard 450-1995. This program will contain the elements relocated from the affected TS LCOs. The parameter values will continue to be controlled at their current level, and actions will be implemented in accordance with the plant corrective action program. Furthermore, the battery and its preventive maintenance and monitoring are under the regulatory requirements of the Maintenance Rule, 10 CFR 50.65. This relocation will continue to assure the battery is maintained at current levels of performance, while allowing the TS to focus on parameter value degradations that approach values which may impact battery operability.

All of the items proposed to be relocated within this new program will be contained in the Technical Requirements Manual (TRM), which is incorporated by reference in the SSES FSAR. This will make all changes subject to review under 10 CFR 50.59, "Changes, Tests, and Experiments," to determine if the proposed changes will require prior NRC review and approval, and will require reporting of all changes to the NRC in accordance 10 CFR 50.71(e), "Maintenance of Records, Making of Reports."

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

The Commission has provided standards in 10 CFR 50.92(c) for determining whether a significant hazards consideration exists. A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

PPL proposes changes to Appendix A, Technical Specifications (TS), of Facility Operating License Nos. NPF-14 and NPF-22 for the Susquehanna Steam Electric Station Units 1 and 2 respectively.

The proposed changes restructure TS Section 3.8.4, "DC Sources – Operating," Section 3.8.5, "DC Sources – Shutdown," and Section 3.8.6, "Battery Cell Parameters" and request new actions with increased completion times for an inoperable battery charger as well as request an alternate battery charger testing criteria for Limiting Condition for Operation (LCO) 3.8.4 and LCO 3.8.5. The proposed changes also include the relocation of a number of Surveillance Requirements (SRs) in TS Section 3.8.4, that perform preventive maintenance on the safety related batteries, propose that TS Table 3.8.6-1, "Battery Cell Parameter Requirements," be relocated to a licensee-controlled program, and specific actions with associated completion times for out-of-limits conditions for battery cell voltage, electrolyte level, and electrolyte temperature be added to TS Section 3.8.6. In addition, specific SRs are being proposed for verification of these parameters.

A new program is being proposed for the maintenance and monitoring of station batteries based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." This program will be described in new TS Section 5.5.13, "Battery Monitoring and Maintenance Program." All of the items proposed to be relocated will be contained within this new program

In accordance with the criteria set forth in 10 CFR 50.92, PPL has evaluated the proposed TS change and determined it does not represent a significant hazards consideration. The following is provided in support of this conclusion.

1. **Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   No. The proposed changes restructure the Technical Specifications (TSs) for the DC Electrical Power Systems. The proposed changes add actions to specifically address battery charger inoperability. This change will rely upon the capability of providing the battery charger function by an alternate means (e.g., a 125 volts direct current (VDC) portable battery charger or a 250 VDC portable battery charger) to justify the proposed Completion Times. The DC electrical power systems, including associated battery chargers, are not initiators to any accident sequence analyzed in the Final Safety Analysis Report (FSAR). Operation in accordance with the proposed TS ensures that the DC electrical power systems are capable of performing functions as described in the FSAR. Therefore the mitigative functions supported by the DC Power Systems will continue to provide the protection assumed by the analysis.

The relocation of preventive maintenance surveillance, and certain operating limits and actions to a newly-created, licensee-controlled TS 5.5.13, "Battery Monitoring and Maintenance Program," will not challenge the ability of the DC electrical power systems to perform their design functions. The maintenance and monitoring required by current TS, which are based on industry standards, will continue to be performed. In addition, the DC Power Systems are within the scope of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," which will ensure the control of maintenance activities associated with the DC electrical power systems. The integrity of fission product barriers, plant configuration, and operating procedures as described in the FSAR will not be affected by the proposed changes.

Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

No. The proposed changes involve restructuring the TS for the DC electrical power systems. These changes will rely upon the capability of providing the battery charger function by an alternate means to justify the proposed completion times when a normal battery charger is inoperable. The DC electrical power systems, which include the associated battery chargers, are not initiators to any accident sequence analyzed in the FSAR. Rather, the DC electrical power systems are used to supply equipment used to mitigate an accident. These mitigative functions, supported by the DC electrical power systems are not affected by these changes and they will continue to provide the protection assumed by the safety analysis described in the FSAR. There are no new types of failures or new or different kinds of accidents or transients that could be created by these changes. Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

No. The margin of safety is established through equipment design, operating parameters, and the setpoints at which automatic actions are initiated. The proposed changes will not adversely affect operation of plant equipment. These changes will not result in a change to the setpoints at which protective actions are initiated. Sufficient DC electrical system capacity is ensured to support operation of mitigation equipment. The changes associated with the new Battery Maintenance and Monitoring Program will ensure that the station batteries are maintained in a highly reliable state. The use of spare battery chargers will increase the reliability of the DC electrical systems during periods of normal battery charger inoperability. The equipment fed by the DC electrical sources will continue to provide adequate power to safety related loads in accordance with analysis assumptions. Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

5.2 Applicable Regulatory Requirements/Criteria

These proposed changes are consistent with TSTF-360, Revision 1 (Reference 1), submitted to the NRC by the Technical Specifications Task Force (TSTF). TSTF-360, Revision 1, was approved by the NRC on December 18, 2000 (Reference 2), and has been incorporated into Revision 2 of NUREG-1433, "Standard Technical Specifications, General Electric Plants, BWR/4," issued by the NRC (Reference 3).

Further, the proposed changes are consistent with submittals by Clinton (Reference 4), Limerick (Reference 5), Dresden (Reference 6), Diablo Canyon (Reference 7), and Comanche Peak (Reference 8) which have received NRC approval. In addition, the issues identified in the Oyster Creek Request for Additional Information (Reference 9), have also been addressed.

6.0 ENVIRONMENTAL CONSIDERATION

10 CFR 51.22(c)(9) identifies certain licensing and regulatory actions, which are eligible for categorical exclusion from the requirement to perform an environmental assessment. A proposed amendment to an operating license for a facility does not require an environmental assessment if operation of the facility in accordance with the proposed amendment would not (1) involve a significant hazards consideration; (2) result in a significant change in the types or significant increase in the amounts of any effluents that may be released offsite; or (3) result in a significant increase in individual or cumulative occupational radiation

exposure. PPL has evaluated the proposed change and has determined that the proposed change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Accordingly, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with issuance of the amendment. This determination, using the above criteria, is:

1. As demonstrated in the No Significant Hazards Consideration Evaluation, the proposed amendment does not involve a significant hazards consideration.

2. There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite. The proposed change does not involve any physical alteration of the plant (no new or different type of equipment will be installed) or change in methods governing normal plant operation.

7.0 REFERENCES

1. Technical Specifications Task Force (TSTF) Traveler TSTF-360, Revision 1, "DC Electrical Rewrite."

2. Letter from W. D. Beckner (USNRC) to A. R. Pietrangelo, (Nuclear Energy Institute) dated December 18, 2000.

3. NUREG-1433, "Standard Technical Specifications, General Electric Plants, BWR/4," Revision 2, April 30, 2001.

4. Letter from J. B. Hopkins (USNRC) to O. D. Kingsley, (Exelon Nuclear) dated February 15, 2002.

5. Letter from S. P. Wall (USNRC) to J. L. Skolds, Exelon Nuclear) dated January 29, 2003.

6. Letter from M. Banerjee (USNRC) to C. M. Crane, (Exelon Nuclear) dated June 8, 2004.

7. Letter from J. Donohew (USNRC) to G. M. Rueger, (Pacific Gas and Electric) dated September 20, 2004.

8. Letter from M. C. Thadani (USNRC) to M. R. Blevins, (TXU Energy) dated July 1, 2004.

9. Letter from M. P. Gallagher, (AmerGen Energy Company) to USNRC dated March 31, 2004.

Attachment 1 to PLA-5825

Proposed Units 1 & 2 Technical Specification Changes (Markups)

3.8.4 DC Sources—Operating

LCO 3.8.4 The DC electrical power subsystems in Table 3.8.4-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
------------NOTE------------ Conditions A, B and C not applicable to DG E DC electrical power subsystem. ------------------------------		
A. One battery charger on one 125 VDC electrical power subsystem inoperable, OR The 250 VDC Division II electrical power subsystem battery charger inoperable, OR Two battery chargers on 250 VDC Division I electrical power subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. AND A.2 Verify battery float current ≤ 2amps. AND A.3 Restore battery chargers to OPERABLE status.	2 hours Once per 12 hours 7 days
B. One 125 VDC battery bank or one 250 VDC battery bank inoperable.	B.1 Restore battery to OPERABLE status.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~A~~C. One Unit 1 DC electrical power subsystem inoperable for reasons other than Condition A or B.	~~A~~C.1	Restore Unit 1 DC electrical power subsystem to OPERABLE status.	2 hours
~~B~~D. Required Action and Associated Completion Time of Conditions A, B, or C not met.	~~B~~D.1	Be in MODE 3.	12 hours
	AND		
	~~B~~D.2	Be in MODE 4.	36 hours
~~C~~E. Diesel Generator E DC electrical power subsystem inoperable, when not aligned to the Class 1E distribution system.	~~C~~E.1	Verify that all ESW valves associated with Diesel Generator E are closed.	2 hours
~~D~~F. Diesel Generator E DC electrical power subsystem inoperable, when aligned to the Class 1E distribution system.	~~D~~F.1	Declare Diesel Generator E inoperable.	2 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltages ~~when on float charge are~~: ~~a. ≥ 129 V for the 125 V batteries; and~~ ~~b. ≥ 258 V for the 250 V batteries.~~ is greater than or equal to the minimum established float voltage.	~~NOTE~~ ~~The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 24 hours.~~ ------------------------ 7 days ~~AND~~ ~~14 days~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.2~~	~~Verify for each battery terminal and connector:~~ ~~No visible corrosion.~~ ~~OR~~ ~~Battery terminal and connection resistance is:~~ ~~a. ≤ 50.0E-6 ohms; or~~ ~~b. ≤ 100.0E-6 ohms with the calculated average resistance for the battery ≤ 50.0E-6 ohms.~~	~~92 days~~
~~SR 3.8.4.3~~	~~Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could potentially degrade battery performance.~~	~~18 months~~
~~SR 3.8.4.4~~	~~Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.~~	~~18 months~~
~~SR 3.8.4.5~~	~~Verify the battery connection resistance is:~~ ~~a. ≤ 100.0E-6 ohms for any single connection; and~~ ~~b. The calculated average resistance for the battery is ≤ 50.0E-6 ohms.~~	~~18 months~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.62	Verify each required battery charger supplies its associated batteriesy at the following rates for ≥ 4 hours: at greater than or equal to the minimum established float voltages a. ≥ 100 amps for the 125V Battery at ≥ 127.8V b. ≥ 300 amps for the 250V Battery at ≥ 255.6V c. ≥ 200 amps for the 125V Diesel Generator E Battery at ≥ 127.8V OR Verify each battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	24 months
SR 3.8.4.73	------------------------------NOTES------------------------------ 1. The modified performance discharge test in SR 3.8.4.86.6 may be performed in lieu of the service test in SR 3.8.4.7 3once per 60 months. 2. This Surveillance shall not be Performed in Mode 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.8.4.8~~	~~NOTE~~ ~~This Surveillance shall not be Performed in Mode 1, 2, or 3.~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.~~	~~60 months~~ ~~AND~~ ~~12 months when battery shows degradation or has reached 85% of expected service life with capacity < 100% of manufacturer's rating~~ ~~AND~~ ~~24 months when battery has reached 85% of the expected service life with capacity ≥ 100% of manufacturer's rating~~

Table 3.8.4-1 (page 1 of 1)
Unit 1 DC Electrical Power Subsystems

TYPE	VOLTAGE	DIVISION I	DIVISION II
Battery Banks	250 V	1D650 1D653A (Charger) or 1D653B (Charger)	1D660 1D663 (Charger)
	125 V	1D610 (Subsys. A) 1D613 (Charger A) 1D630 (Subsys. C) 1D633 (Charger C)	1D620 (Subsys. B) 1D623 (Charger B) 1D640 (Subsys. D) 1D643 (Charger D)
DG E Battery Banks	125 V	0D595 0D596 (Charger)	

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources—Shutdown

LCO 3.8.5 DC electrical power subsystems listed in Table 3.8.4.1 shall be OPERABLE as needed to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems - Shutdown."

APPLICABILITY: MODES 4 and 5,
During movement of irradiated fuel assemblies in the secondary containment.

ACTIONS

-----NOTE-----
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. -----NOTE----- - Conditions A and B nNot applicable to DG E DC electrical power subsystem. -----		
A. One battery charger on one 125 VDC electrical power subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
OR	AND	
The 250 VDC Division II electrical power subsystem battery charger inoperable,	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
OR	AND	
Two battery chargers on 250 VDC Division I electrical power subsystem inoperable.	A.3 Restore battery chargers to OPERABLE status.	7 days

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
AND A. (continued) The redundant electrical power subsystem battery and charger OPERABLE.		
AB. One or more required Unit 1 DC electrical power subsystems inoperable, for reasons other than Condition A. OR Required Action and associated Completion Time of Condition A not met.	AB.1 Declare affected required feature(s) inoperable.	Immediately
	OR	
	AB.2.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	AB.2.2 Suspend movement of irradiated fuel assemblies in the secondary containment.	Immediately
	AND	
	AB.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.	Immediately
	AND	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
	~~A~~B.2.4 Initiate action to restore required Unit 1 DC electrical power subsystems to OPERABLE status.	Immediately
~~B~~C. Diesel Generator E DC electrical power subsystem inoperable, while not aligned to the Class 1E distribution system.	~~B~~C.1 Verify that all ESW valves associated with Diesel Generator E are closed.	2 hours
~~C~~D. Diesel Generator E DC electrical power subsystem inoperable, while aligned to the Class 1E distribution system.	~~C~~D.1 Declare Diesel Generator E inoperable.	2 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	------------------------------NOTE------------------------------ The following SRs must be met, but are not required to be performed: SR 3.8.4.~~6~~2, and SR 3.8.4.~~7~~3~~, and SR 3.8.4.8~~. --- For DC sources required to be OPERABLE the following SRs are applicable: SR 3.8.4.1 ~~SR 3.8.4.4~~ ~~SR 3.8.4.7~~ SR 3.8.4.2 ~~SR 3.8.4.5~~ ~~SR 3.8.4.8.~~ SR 3.8.4.3 ~~SR 3.8.4.6~~	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery ~~Cell~~ Parameters

LCO 3.8.6 Battery ~~cell~~ parameters for the Class 1E 250 V batteries and Class 1E 125 V batteries shall be within limits.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A. One or more batteries with one or more battery cell parameters not within Category A or B limits.~~	~~A.1 Verify pilot cell electrolyte level and float voltage meet Table 3.8.6-1 Category C limits.~~	~~1 hour~~
	~~AND~~	
	~~A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C limits.~~	~~24 hours~~ ~~AND~~ ~~Once per 7 days thereafter~~
	~~AND~~	
	~~A.3 Restore battery cell parameters to Category A and B limits of Table 3.8.6-1.~~	~~31 days~~
A. One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with one or more battery cells float voltage < 2.07 V.	A.1 Perform SR 3.8.4.1	2 hours
	AND	
	A.2 Perform SR 3.8.6.1	2 hours
	AND	
	A.3 Restore affected cell voltage ≥ 2.07 V.	24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with float current > 2 amps.	B.1 Perform SR 3.8.4.1 AND B.2 Restore battery float current to < 2 amps.	2 hours 12 hours
C. ----------NOTE---------- Required Action C.2 shall be completed if electrolyte level was below the top of plates. ------------------------------ One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with one or more cells electrolyte level less than minimum established design limits.	----------NOTE---------- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. ------------------------------ C.1 Restore electrolyte level to above top of plates. AND C.2 Verify no evidence of leakage. AND C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	 8 hours 12 hours 31 days
D. One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Two 125 VDC electrical power subsystems or both 250 VDC electrical power subsystems with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one 125 VDC electrical power subsystem or one 250 VDC electrical power subsystem to within limits.	2 hours
~~B~~F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR ~~One or more batteries with average electrolyte temperature of the representative cells not within limits.~~ ~~OR~~ ~~One or more batteries with one or more battery cell parameters not within Category C values.~~ One battery on one 125 VDC electrical power subsystem or one 250 VDC electrical power subsystem with one or more battery cells float voltage < 2.07 V and float current > 2 amps.	~~B~~F.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.6.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits. -----NOTE----- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. ---------- Verify each battery float current is ≤ 2 amps.	-----NOTE----- The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 4 days. ---------- 7 days AND 14 days
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ 2.07 V.	31 days
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V.	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.6	------------------------------NOTE------------------------------ This Surveillance shall not be Performed in Mode 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached 85% of expected service life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached 85% of the expected service life with capacity ≥ 100% of manufacturer's rating

~~SURVEILLANCE REQUIREMENTS (continued)~~

~~SURVEILLANCE~~		~~FREQUENCY~~
~~SR 3.8.6.2~~	~~Verify battery cell parameters meet Table 3.8.6-1 Category B limits.~~	~~92 days~~ ~~AND~~ ~~Once within 24 hours after battery discharge < 110 V for 125 V DC and < 220 V for 250 V DC~~ ~~AND~~ ~~Once within 24 hours after battery overcharge > 150 V for 125 V DC and > 300 V for 250 V DC~~
~~SR 3.8.6.3~~	~~Verify average electrolyte temperature of representative cells is ≥ 60°F for each Class 1E battery.~~	~~92 days~~

Table 3.8.6-1 (page 1 of 1)
Battery Cell Parameter Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	≥ Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[(a)]	≥ Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[(a)]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity[(b)(c)]	≥ 1.200	≥ 1.195 AND Average of all connected cells > 1.205	Not more than 0.020 below average of all connected cells AND Average of all connected cells ≥ 1.195

(a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during and immediately following equalizing charges provided it is not overflowing.

(b) Corrected for electrolyte temperature. Level correction is not required.

(c) A battery charging current of < 0.25 amp for Class 1E 250 V batteries and < 0.1 amp Class 1E 125 V batteries when on float charge is acceptable for meeting specific gravity limits.

5.5 Programs and Manuals (continued)

5.5.13 Battery Monitoring and Maintenance Program

This program provides for battery restoration and maintenance, based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications," including the following:

a. Actions to restore battery cells with float voltage < 2.13 V, and

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the minimum established design limit.

(continued)

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources—Operating

LCO 3.8.4 The DC electrical power subsystems in Table 3.8.4-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
-------------NOTE------------ Conditions A, B and C not applicable to DG E DC electrical power subsystem. ------------------------------		
A. One battery charger on one 125 VDC electrical power subsystem inoperable, OR The 250 VDC Division II electrical power subsystem battery charger inoperable, OR Two battery chargers on 250 VDC Division I electrical power subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. AND A.2 Verify battery float current ≤ 2 amps. AND A.3 Restore battery chargers to OPERABLE status.	2 hours Once per 12 hours 7 days
B. One 125 VDC battery bank or one 250 VDC battery bank inoperable.	B.1 Restore battery to OPERABLE status.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
AC. One Unit 2 DC electrical power subsystem inoperable for reasons other than Condition A or B.	AC.1 Restore Unit 2 DC electrical power subsystem to OPERABLE status.	2 hours
BD. Required Action and Associated Completion Time of Conditions A, B, or C not met.	BD.1 Be in MODE 3.	12 hours
	AND	
	BD.2 Be in MODE 4.	36 hours
CE. Diesel Generator E DC electrical power subsystem inoperable, when not aligned to the Class 1E distribution system.	CE.1 Verify that all ESW valves associated with Diesel Generator E are closed.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~D~~F. Diesel Generator E DC electrical power subsystem inoperable, when aligned to the Class 1E distribution system.	~~D~~F.1 Declare Diesel Generator E inoperable.	2 hours
~~E~~G. One or more Unit 1 DC electrical power subsystem(s) inoperable.	~~E~~G.1 Transfer associated Unit 1 and common loads to corresponding Unit 2 DC electrical power subsystem.	2 hours
	AND	
	~~E~~G.2 Restore Unit 1 and common loads to corresponding Unit 1 DC electrical power subsystem.	72 hours after Unit 1 DC electrical power subsystem is restored to OPERABLE status.
~~F~~H. Required Actions and associated Completion Times of Condition E not met.	~~F~~H.1 Declare associated common loads inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage~~s when on float charge are:~~ ~~a. ≥ 129 V for the 125 V batteries; and~~ ~~b. ≥ 258 V for the 250 V batteries.~~ is greater than or equal to the minimum established float voltage.	~~-----NOTE-----~~ ~~The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 24 hours.~~ --------------- 7 days ~~AND~~ ~~14 days~~
~~SR 3.8.4.2~~	~~Verify for each battery terminal and connector:~~ ~~No visible corrosion.~~ ~~OR~~ ~~Battery terminal and connection resistance is:~~ ~~a. ≤ 50.0E-6 ohms; or~~ ~~b. ≤ 100.0E-6 ohms with the calculated average resistance for the battery ≤ 50.0E-6 ohms.~~	~~92 days~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could potentially degrade battery performance.	18 months
SR 3.8.4.4	Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	18 months
SR 3.8.4.5	Verify the battery connection resistance is: a. ≤ 100.0E-6 ohms for any single connection. b. The calculated average resistance for the battery is ≤ 50.0E-6 ohms.	18 months
SR 3.8.4.62	Verify each required battery charger supplies its associated batteriesy at the following rates for ≥ 4 hours: at greater than or equal to the minimum established float voltages: a) ≥ 100 amps for the 125V Battery at ≥ 127.8V b) ≥ 300 amps for the 250V Battery at ≥ 255.6V c) ≥ 200 amps for the125V Diesel Generator E Battery at ≥ 127.8V OR Verify each battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.~~7~~3	------------NOTES------------ 1. The modified performance discharge test in SR 3.8.~~4.8~~ 6.6 may be performed in lieu of ~~the service test in~~ SR 3.8.4.~~7~~3 ~~once per 60 months.~~ 2. This Surveillance shall not be Performed in MODE 1, 2 or 3. However, credit may be taken for unplanned events that satisfy this SR. ------------------------------------ Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
~~SR 3.8.4.8 ——NOTE—— This Surveillance shall not be Performed in MODE 1, 2, or 3.~~ ~~Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.~~	~~60 months~~ ~~AND~~ ~~12 months when battery shows degradation or has reached 85% of expected service life with capacity < 100% of manufacturer's rating~~ ~~AND~~ ~~24 months when battery has reached 85% of the expected service life with capacity ≥ 100% of manufacturer's rating~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.9 4	--------------------------NOTE-------------------------- When Unit 1 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 1 SR 3.8.5.1 is applicable. -- - For required Unit 1 DC electrical power subsystems, the SRs for Unit 1 Specification 3.8.4 are applicable.	In accordance with applicable SRs

Table 3.8.4-1 (page 1 of 1)
Unit 2 DC Electrical Power Subsystems

TYPE	VOLTAGE	DIVISION I	DIVISION II
Battery Banks	250 V	2D650 2D653A (Charger) or 2D653B (Charger)	2D660 2D663 (Charger)
	125 V	1D610 (Subsys. A) 1D613 (Charger A) 2D610 (Subsys. A) 2D613 (Charger A) 1D630 (Subsys. C) 1D633 (Charger C) 2D630 (Subsys. C) 2D633 (Charger C)	1D620 (Subsys. B) 1D623 (Charger B) 2D620 (Subsys. B) 2D623 (Charger B) 1D640 (Subsys. D) 1D643 (Charger D) 2D640 (Subsys. D) 2D643 (Charger D)
DG E Battery Banks	125 V	0D595 0D596 (Charger)	

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources—Shutdown

LCO 3.8.5 DC electrical power subsystems listed in Table 3.8.4.1 shall be OPERABLE as needed to support the DC electrical power distribution subsystem(s) required by LCO 3.8.8, "Distribution Systems - Shutdown."

APPLICABILITY: MODES 4 and 5,
During movement of irradiated fuel assemblies in the secondary containment.

ACTIONS

-----NOTE-----
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A.~~ -----NOTE----- Conditions A and B ~~Not~~ not applicable to DG E DC electrical power subsystem. -----		
A. One battery charger on one 125 VDC electrical power subsystem inoperable.	A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours
OR	AND	
The 250 VDC Division II electrical power subsystem battery charger inoperable.	A.2 Verify battery float current ≤ 2 amps.	Once per 12 hours
OR	AND	
Two battery chargers on one 250 VDC Division I electrical power subsystem inoperable.	A.3 Restore battery chargers to OPERABLE status.	7 days

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
AND A. (continued) The redundant electrical power subsystem battery and charger OPERABLE.		
AB. One or more required Unit 2 DC electrical power subsystems inoperable, for reasons other than Condition A	AB.1 Declare affected required feature(s) inoperable.	Immediately
OR	OR	
Required Action and associated Completion Time of Condition A not met.	AB.2.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	AB.2.2 Suspend movement of irradiated fuel assemblies in the secondary containment.	Immediately
	AND	
	AB.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.	Immediately
	AND	
	AB.2.4 Initiate action to restore required Unit 2 DC electrical power subsystems to OPERABLE status.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~C. Diesel Generator E DC electrical power subsystem inoperable, while not aligned to the Class 1E distribution system.	~~B~~C.1 Verify that all ESW valves associated with Diesel Generator E are closed.	2 hours
~~C~~D. Diesel Generator E DC electrical power subsystem inoperable, while aligned to the Class 1E distribution system.	~~C~~D.1 Declare Diesel Generator E inoperable.	2 hours
~~D~~E. ------------NOTE------------ Not applicable to DG E DC electrical power subsystem. ------------------------------------ One or more inoperable required Unit 1 DC electrical power subsystem.	~~D~~E.1 Declare affected required feature(s) inoperable	Immediately
	<u>OR</u>	
	~~D~~E.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	~~D~~E.2.2 Suspend movement of irradiated fuel assemblies in the secondary containment.	Immediately
	<u>AND</u>	
	~~D~~E.2.3 Initiate action to suspend operations with a potential for draining the vessel.	Immediately
	<u>AND</u>	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~D~~E. (continued)	~~D~~E.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status. OR	Immediately
	~~D~~E.3.1 Initiate action to transfer Unit 1 and common loads to corresponding Unit 2 DC electrical power subsystem.	Immediately
	AND	
	~~D~~E.3.2.1 Restore Unit 1 and common loads to corresponding Unit 1 DC electrical power subsystems.	72 hours after Unit 1 DC electrical power subsystem is restored to OPERABLE status.
	OR	
	~~D~~E.3.2.2 Declare associated Unit 1 and common loads inoperable.	72 hours after Unit 1 DC electrical power subsystem is restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	---NOTE--- The following SRs must be met, but are not required to be performed: SR 3.8.4.~~6~~2~~,~~ and SR 3.8.4.~~7~~3~~, and SR 3.8.4.8~~. --- For DC sources required to be OPERABLE the following SRs are applicable: SR 3.8.4.1, SR 3.8.4.2, SR 3.8.4.3, ~~SR 3.8.4.4~~, ~~SR 3.8.4.5~~, ~~SR 3.8.4.6~~, ~~SR 3.8.4.7~~, ~~SR 3.8.4.8.~~	In accordance with applicable SRs
SR 3.8.5.2	---NOTE--- When Unit 1 is in MODE 4 or 5, or moving irradiated fuel assemblies in the secondary containment, the Note to Unit 1 SR 3.8.5.1 is applicable. --- For required Unit 1 DC electrical power subsystems, the SRs for Unit 1 Specification 3.8.4 are applicable.	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery ~~Cell~~ Parameters

LCO 3.8.6 Battery ~~cell~~ parameters for the Class 1E 250 V batteries and Class 1E 125 V batteries shall be within limits.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

-----NOTE-----

Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A. One or more batteries with one or more battery cell parameters not within Category A or B limits.~~	~~A.1 Verify pilot cell electrolyte level and float voltage meet Table 3.8.6-1 Category C limits.~~	~~1 hour~~
	~~AND~~	
	~~A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C limits.~~	~~24 hours~~ ~~AND~~ ~~Once per 7 days thereafter~~
	~~AND~~	
	~~A.3 Restore battery cell parameters to Category A and B limits of Table 3.8.6-1.~~	~~31 days~~

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with one or more battery cells float voltage < 2.07 V.	A.1 Perform SR 3.8.4.1 AND A.2 Perform SR 3.8.6.1 AND A.3 Restore affected cell voltage ≥ 2.07 V.	2 hours 2 hours 24 hours
B. One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with float current > 2 amps.	B.1 Perform SR 3.8.4.1 AND B.2 Restore battery float current to ≤ 2 amps	2 hours 12 hours
C. ----------NOTE---------- Required Action C.2 shall be completed if electrolyte level was below the top of plates. ---------- One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with one or more cells electrolyte level less than minimum established design limits.	----------NOTE---------- Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. ---------- C.1 Restore electrolyte level to above top of plates. AND C.2 Verify no evidence of leakage. AND	 8 hours 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
	C.3 Restore electrolyte level to greater than or equal to minimum established design limits.	31 days
D. One 125 VDC electrical power subsystem and/or one 250 VDC electrical power subsystem with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.	12 hours
E. Two 125 VDC electrical power subsystems or both 250 VDC electrical power subsystems with battery parameters not within limits.	E.1 Restore battery parameters for batteries in one 125 VDC electrical power subsystem or one 250 VDC electrical power subsystem to within limits.	2 hours
BF. Required Action and associated Completion Time of Condition A A, B, C, D, or E not met. OR One or more batteries with average electrolyte temperature of the representative cells not within limits. OR One or more batteries with one or more battery cell parameters not within Category C values.	BF.1 Declare associated battery inoperable.	Immediately

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued) One battery on one 125 VDC electrical power subsystem or on one 250 VDC electrical power subsystem with one or more battery cells float voltage < 2.07 V and float current > 2 amps.		

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	Verify battery cell parameters meet Table 3.8.6.1 Category A limits. --------------------NOTE-------------------- Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. -- Verify each battery float current is ≤ 2 amps.	NOTE The 7 day Frequency is not applicable if the battery is on equalize charge or has been on equalize charge at any time during the previous 4 days. 7 days AND 14 days
SR 3.8.6.2	Verify each battery pilot cell voltage is ≥ 2.07 V.	31 days
SR 3.8.6.3	Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.6.4	Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.5	Verify each battery connected cell voltage is ≥ 2.07 V.	92 days
SR 3.8.6.6	------------------------NOTE------------------------ This Surveillance shall not be Performed in Mode 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached 85% of expected service life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached 85% of the expected service life with capacity ≥ 100% of manufacturer's rating

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
~~SR 3.8.6.2 Verify battery cell parameters meet Table 3.8.6-1 Category B limits.~~	~~92 days~~ ~~AND~~ ~~Once within 24 hours after battery discharge < 110 V for 125 V DC and < 220 V for 250 V DC~~ ~~Once within 24 hours after battery overcharge > 150 V for 125 V DC and > 300 V for 250 V DC~~
~~SR 3.8.6.3 Verify average electrolyte temperature of representative cells is ≥ 60°F for each Class 1E battery.~~	~~92 days~~

Table 3.8.6-1 (page 1 of 1)
Battery Cell Parameter Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	≥ Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[(a)]	≥ Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[(a)]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V	> 2.07 V
Specific Gravity[(b)(c)]	≥ 1.200	≥ 1.195 AND Average of all connected cells > 1.205	Not more than 0.020 below average of all connected cells AND Average of all connected cells ≥ 1.195

(a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during and immediately following equalizing charges provided it is not overflowing.

(b) Corrected for electrolyte temperature. Level correction is not required.

(c) A battery charging current of < 0.25 amp for Class 1E 250 V batteries and < 0.1 amp Class 1E 125 V batteries when on float charge is acceptable for meeting specific gravity limits.

5.5 Programs and Manuals (continued)

5.5.13 Battery Monitoring and Maintenance Program

This program provides for battery restoration and maintenance, based on the recommendations of IEEE Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications," including the following:

a. Actions to restore battery cells with float voltage < 2.13 V, and

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the minimum established design limit.

(continued)

Attachment 2 to PLA-5825

Proposed Units 1 & 2 Technical Specification Bases Changes (Markups for Information Only)

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

The DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment. As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The Unit 1 DC power sources provide both motive and control power to selected safety related equipment, as well as circuit breaker control power for the nonsafety related 13.8 kV, 4.16 kV, and 480 V and lower AC distribution systems. Each DC subsystem is energized by one 125/250 V battery and at least 1 Class 1E battery charger. The 250 V DC batteries for division I are supported by two ~~half~~ full capacity chargers; the 250 V DC batteries for division II are supported by a full capacity charger; and, the 125 V DC batteries are each supported by a single full capacity charger. Each battery is exclusively associated with a single 125/250 VDC bus and cannot be interconnected with any other 125/250 VDC subsystem. The chargers are supplied from the same AC load groups for which the associated DC subsystem supplies the control power. Transfer switches provide the capability to power Unit 1 and common DC loads from Unit 2 DC sources.

Diesel Generator (DG) E DC power sources provide control and instrumentation power for DG E.

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are automatically powered from the station batteries.

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System—Operating," and LCO 3.8.8, "Distribution System—Shutdown."

(continued)

BASES

BACKGROUND (continued)

Each battery has adequate storage capacity ~~to carry the required load continuously for approximately 4 hours.~~ to meet the duty cycle discussed in the FSAR, Chapter 8 (Ref. 12). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

Each subsystem, including the battery bank, chargers and DC switchgear, is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, or battery chargers.

The batteries for the electrical power subsystems are sized to produce required capacity at 80% of ~~nameplate~~ design rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 105/210 V, at the battery terminals.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit voltage of approximately 124 V for a 60 cell battery (i.e. cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage of 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.2 Vpc corresponds to a total float voltage output of 132 V for a 60 cell battery as discussed in the FSAR, Chapter 8 (Ref. 12).

Each battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger has sufficient ~~excess~~ capacity to restore the battery from the design minimum charge to its fully charged state within design basis requirements while supplying normal steady state loads (Ref. ~~3~~12).

(continued)

BASES

BACKGROUND (continued)

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger (if the discharge was significant, e.g., following a battery service test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 4) and Chapter 15 (Ref. 5), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst case single failure.

The DC sources satisfy Criterion 3 of the NRC Policy Statement (Ref. 6).

(continued)

BASES (continued)

LCO

The DC electrical power subsystems are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. ~~3~~12).

The DC electrical power subsystems include:

a) each Unit 1 DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt or 250 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus; and,

b) the Diesel Generator E DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, and 3 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 4 and 5 are addressed in the Bases for LCO 3.8.5, "DC Sources—Shutdown."

(continued)

BASES (continued)

ACTIONS

A.1, A.2, and A.3

Condition A represents one battery charger on one 125 VDC electrical subsystem inoperable, OR the 250 VDC Division II subsystem battery charger inoperable OR two 250 VDC Division I subsystem battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharger event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery.

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 125 VDC temporary battery chargers shall have sufficient capacity to supply normal DC loads, and accident loads (other than 1st minute LOCA/LOOP loads), while maintaining the batteries operable. The 7 day completion time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

B.1

Condition B represents one 125 VDC battery bank or one 250 VDC battery bank that is inoperable. With one battery inoperable, the DC bus is being supplied by the OPERABLE battery charger. Any event that results in a loss of the AC bus supporting the battery chargers will also result in loss of DC to that 125 VDC or 250 VDC subsystem. Recovery of the AC bus, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed and diesel generator output circuit breakers, etc.) likely rely upon the battery. In addition the energization transients of any DC loads that are beyond the capability of the battery charger and normally require the assistance of the battery will not be able to be brought online. The 2 hour limit allows sufficient time to effect restoration of an inoperable battery given that the majority of the conditions that lead to battery inoperability (e.g., loss of battery charger, battery cell voltage less than 2.07 V, etc.) are identified in Specifications 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

(continued)

BASES

ACTIONS (continued)

AC.1

Condition A-C represents one subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. The 2 hour limit is consistent with the allowed time for an inoperable DC Distribution System division.

If one of the required DC electrical power subsystems is inoperable for reasons other than Condition A or B (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

Conditions A-A, B, and C areis modified by a Note that states that Conditions AA, B and C are is not applicable to the DG E DC electrical power subsystem. Conditions C-E or D-F is are applicable to an inoperable DG E DC electrical power subsystem.

BD.1 and BD.2

If the inoperable Unit 1 DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

(continued)

BASES

ACTIONS (continued)

~~C~~E.1

If Diesel Generator E is not aligned to the class 1E distribution system, the only supported safety function is for the ESW system. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or shutdown Diesel Generator E and close the associated ESW valves in order to ensure the OPERABILITY of the ESW system. The 2 hour limit is consistent with the allowed time for other inoperable DC sources and provides sufficient time to evaluate the condition of the battery and take the corrective actions.

~~D~~F.1

If the Diesel Generator is aligned to the class 1E distribution system, the loss of Diesel Generator E DC power subsystem will result in the loss of a on-site Class 1E power source. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or declare Diesel Generator E inoperable and take Actions of LCO 3.8.1. The 2 hour limit is consistent with the allowed time for other DC sources and provides sufficient time to evaluate the condition of the battery and take the necessary corrective actions.

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the battery chargers, which support the ability of the batteries to perform their intended function. ~~charging system and the ability of the batteries to perform their intended function~~. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery ~~(or battery cell)~~ and maintain the battery ~~(or a battery cell)~~ in a fully charged state while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer (2.20 Vpc or 132 V at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years).

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1 (continued)

The voltage requirements are consistent with the initial voltages assumed in the battery sizing calculations. The This SR must be performed every 7 days consistent with manufacturer recommendations and IEEE-450 (Ref. 8). However, this Frequency is modified by a Note that allows the Frequency to be extended for up to 14 days when the battery is on equalize charge or has been on equalize charge any time during the previous 24 hours. This change recognizes the routine 7 day Frequency must be extended until 24 hours after an equalize charge is completed so that meaningful results are obtained for this SR. The 14 day Frequency is not modified by the Note, therefore, the SR must be performed every 14 days regardless of how often the battery is placed on equalize charge.

SR 3.8.4.2

Visual inspection to detect corrosion of the battery cells and connections; or, measurement of the resistance of each inter-cell, inter-rack, inter-tier, and terminal connection with visible corrosion, provides an indication that there is no physical damage or abnormal deterioration that could potentially degrade battery performance.

The connection resistance limits established for this SR provide two acceptance limits for any connection where there is visible signs of corrosion. The first limit, if met, requires no additional actions and ensures the design capability of the battery is maintained. If the second limit is used, the calculated average resistance for the associated battery determined is SR 3.8.4.5 shall be recalculated using the new resistance value. Resistance values shall be measured for only those connections where there is visible signs of corrosion. To determine the average connection resistance, data from the performance of SR 3.8.4.5 can be used for unaffected connections.

The Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not represent a failure of this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).

The Frequency of this SR is acceptable because other administrative controls ensure adequate battery performance during the 18 month interval. Furthermore, operating experience has shown these components usually pass the Surveillance when performed at the 18 month Frequency; therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provides an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection.

The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR, provided visible corrosion is removed during performance of this Surveillance. The connection resistance limits for this SR must be below the limits specified in the SR. The calculated average resistance limit ensure that the total voltage drop across the battery connections is consistent to those assumed in the battery calculations, while the upper limit for battery resistance prevents the possibility of battery damage due to overheating of the connections.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.4 and SR 3.8.4.5 (continued)

The Frequency of this SR is acceptable because other administrative controls ensure adequate battery performance during the 18 month interval. Furthermore, operating experience has shown these components usually pass the Surveillance when performed at the 18 month Frequency; therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.8.4.62

Battery charger capability requirements are based on This SR verifies the design capacity of the battery chargers (Ref. 3). According to Regulatory Guide 1.32 (Ref. 9), the battery charger supply is required recommended to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying DC current to its associated battery bank at the minimum established float voltage for greater than or equal to 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

The other option requires that each battery charger be capable of recharging the battery bank after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 2 amps.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.6 2 (continued)

The Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 24 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

SR 3.8.4.73

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The test can be conducted using actual or simulated loads. The discharge rate and test length corresponds to the design duty cycle requirements as specified in Reference 12.

The Frequency of 24 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests not to exceed 24 months.

This SR is modified by a two Notes. Note 1 Which allows only the performance of a modified performance discharge test SR 3.8.6.6 in lieu of a service test SR 3.8.4.3 once per 60 months.

~~A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.~~

~~The modified performance discharge test is a test of simulated duty cycle consisting of two different discharge rates. The first discharge rate consists of the one minute published rate for the battery or the largest current loads of the duty cycle followed by a second discharge rate which employs the test rate for the performance discharge test. These discharge rates envelope the duty cycle of the service test. Since the ampere-hours removed by a published one minute discharge rate represent a very small portion of the battery capacity, the test rate can be changed to that for the performance discharge test without comromising.~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 3 (continued)

the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the service test. When the battery loads after the first minute exceeds the performance test discharge rate, the modified performance discharge test is performed by first conducting the service test, than adjusting the discharge rate to the constant current value normally used for the performance discharge test. This test is terminated when the specified minimum battery terminal voltage is reached.

When the battery loads after the first minute exceeds the performance discharge test rate, the battery capacity is calculated as follows:

% of rated capacity at 25°C (77°F) =

$$K\left[\frac{\sum (I_n)(t_n)}{Rated\ Ampere\ Hours}\right] x\ 100$$

Where:

K = Temperature Correction Factor from IEEE 450-1995

I_n = Discharge Current in amps for n-th section

T_n = Duration of n-th section discharge in hour

n = Section number for each portion of the discharge, including both service test and performance test portions

This % of rated capacity equation uses the temperature corrected Ampere Hours instead of the temperature corrected discharge rates as specified in IEEE 450-1995. It is not possible to temperature correct the discharge rate without impacting the service test.

The SR is modified by a Note. The reason for the Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance. Examples of unplanned events may include:

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.3 (continued)

1.) Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation is available; and

2.) Post maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

~~SR 3.8.4.8~~

~~A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test.~~

~~The test is intended to determine overall battery degradation due to age and usage.~~

~~A battery modified performance discharge test is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.~~

~~The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 8) and IEEE-485 (Ref. 11). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.~~

~~The Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected service life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~SR 3.8.4.8 (continued)~~

~~indicated, according to IEEE-450 (Ref. 8), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 8).The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems.~~

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6.
3. IEEE Standard 308.
4. FSAR, Chapter 6.
5. FSAR, Chapter 15.
6. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).
7. Regulatory Guide 1.93.
8. IEEE Standard 450.
9. Regulatory Guide 1.32, February 1977.
10. Regulatory Guide 1.129, April 1977, February 1978.
11. IEEE Standard 485~~, 1983~~.
12. FSAR, Chapter 8, Section 8.3.2.1.1.6

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources-Shutdown

BASES

BACKGROUND

A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources—Operating."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum DC electrical power sources during MODES 4 and 5 and during movement of irradiated fuel assemblies ensures that:

a. The facility can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel handling accident.

LCO 3.8.5 is normally satisfied by maintaining the OPERABILITY of all Division I or all Division II DC sources listed in Table 3.8.4-1 and the Diesel Generator E battery bank. However, any combination of DC sources that maintain OPERABILITY of equipment required by Technical Specifications may be used to satisfy this LCO. The DC sources satisfy Criterion 3 of the NRC Policy Statement (Ref. 3).

(continued)

BASES (continued)

LCO

The DC electrical power subsystems are required to be OPERABLE as needed to support required DC distribution subsystems required OPERABLE by LCO 3.8.8, "Distribution Systems—Shutdown." This requirement ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents and inadvertent reactor vessel draindown).

The DC electrical power subsystems consist of the following:

a) each Unit 1 DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt or 250 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus; and,

b) the Diesel Generator E DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus.

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 4 and 5 and during movement of irradiated fuel assemblies in the secondary containment provide assurance that:

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;

b. Required features needed to mitigate a fuel handling accident are available;

c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The DC electrical power requirements for MODES 1, 2, and 3 are covered in LCO 3.8.4.

(continued)

BASES (continued)

ACTIONS

The ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. This is acceptable because LCO 3.0.3 would not specify any additional actions while in MODE 4 or 5 and moving irradiated fuel assemblies.

A.1, A.2, and A.3

Condition A represents one battery charger on one 125 VDC electrical subsystem inoperable, OR the 250 VDC Division II subsystem battery charger inoperable OR two 250 VDC Division I subsystem battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery.

(continued)

ACTIONS

A.1, A.2, and A.3 (continued)

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharger event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 125 VDC temporary battery chargers shall have sufficient capacity to supply normal DC loads, and accident loads (other than 1st minute LOCA/LOOP loads), while maintaining the batteries operable. The 7 day completion time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

(continued)

BASES

ACTIONS (continued)

AB.1, AB.2.1, AB.2.2, AB.2.3, and AB.2.4

If more than one Unit 1 DC distribution subsystem is required according to LCO 3.8.8, the remaining operable Unit 1 DC subsystems may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. Therefore, the option is provided to declare required features with associated DC power sources inoperable which ensures that appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS.

In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and any activities that could result in inadvertent draining of the reactor vessel). Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required Unit 1 DC electrical power subsystems and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the plant safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystems should be completed as quickly as possible in order to minimize the time during which the plant safety systems may be without sufficient power.

Conditions A and B is are modified by a Note that states that Conditions A and B is are not applicable to the DG E DC electrical power subsystem. Conditions B C or and C D is are applicable to an inoperable DG E DC electrical power subsystem.

(continued)

BASES

ACTIONS (continued)

BC.1

If Diesel Generator E is not aligned to the class 1E distribution system, the only supported safety function is for the ESW system. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE, to ensure the OPERABILITY of the ESW system, actions are taken to restore the battery to OPERABLE status. The 2 hour limit is consistent with the allowed time for other inoperable DC sources that result in a loss of safety function and provides sufficient time to evaluate the condition of the battery and take the corrective actions.

CD.1

If the Diesel Generator E is aligned to the class 1E distribution system, the loss of Diesel Generator E DC power subsystem will result in the loss of a on-site Class 1E power source. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or declare Diesel Generator E inoperable and take Actions of LCO 3.8.2. The 2 hour limit is consistent with the allowed time for other DC sources that result in a loss of safety function and provides sufficient time to evaluate the condition of the battery and take the necessary corrective actions.

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.83. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

(continued)

BASES (continued)

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery ~~Cell~~ Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage, ~~and specific gravity~~ for the DC electrical power subsystems batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources— Operating," and LCO 3.8.5, "DC Sources—Shutdown." In addition to the limitations of this Specification, the Battery Monitoring and Maintenance Program also implements a program specified in Specification 5.5.13 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450-1995, IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref. 4).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 124 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage > 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long-term performance however, is obtained by maintaining a float voltage of 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge. The nominal float voltage of 2.2 Vpc corresponds to a total float voltage output of 132 V for a 60 cell battery as discussed in the FSAR, Chapter 8 (Ref. 5).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources identified in Table 3.8.4-1 OPERABLE during accident conditions, in the event of:

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

a. An assumed loss of all offsite AC or all onsite AC power; and

b. A worst case single failure.

Since battery ~~cell~~ parameters support the operation of the DC electrical power subsystems, they satisfy Criterion 3 of the NRC Policy Statement (Ref. 3).

LCO

Battery ~~cell~~ parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA.

(continued)

BASES

LCO (continued)

~~Electrolyte~~ Battery parameter limits are conservatively established, allowing continued DC electrical system function even with ~~Category A and B~~ limits not met. Additional preventative maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.13, Programs and Manuals.

APPLICABILITY

The battery ~~cell~~ parameters are required solely for the support of the associated DC electrical power subsystem. Therefore, battery ~~cell~~ parameters are required to be within required limits only when the associated DC power source is required to be OPERABLE. Refer to the Applicability discussions in Bases for LCO 3.8.4 and LCO 3.8.5.

ACTIONS

A Note has been added to provide clarification that, for the purpose of this LCO, separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable battery. Complying with the Required Actions may allow for continued operation, and subsequent inoperable batteries are governed by subsequent Condition entry and application of associated Required Actions.

~~A.1, A.2, and A.3~~

~~With parameters of one or more cells in one or more batteries not within limits (i.e., Category A limits not met or Category B limits not met, or Category A and B limits not met) but within the Category C limits specified in Table 3.8.6-1, the battery is degraded but there is still sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of Category A or B limits not met, and continued operation is permitted for a limited period.~~

~~The pilot cell electrolyte level and float voltage are required to be verified to meet the Category C limits within 1 hour (Required Action A.1). This check provides a quick indication of the status of the remainder of the battery cells. One hour provides time to inspect the electrolyte~~

(continued)

BASES

ACTIONS

~~A.1, A.2, and A.3 (continued)~~

~~level and to confirm the float voltage of the pilot cell. One hour is considered a reasonable amount of time to perform the required verification.~~

~~Verification that the Category C limits are met (Required Action A.2) provides assurance that during the time needed to restore the parameters to the Category A and B limits, the battery is still capableof performing its intended function. A period of 24 hours is allowed to complete the initial verification because specific gravity measurements must be obtained for each connected cell. Taking into consideration both the time required to perform the required verification and the assurance that the battery cell parameters are not severely degraded, this time is considered reasonable. The verification is repeated at 7 day intervals until the parameters are restored to Category A and B limits. This periodic verification is consistent with the normal Frequency of pilot cell Surveillances.~~

~~Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A and B limits. Taking into consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery cell parameters to normal limits, this time is acceptable for operation prior to declaring the DC batteries inoperable.~~

A.1, A.2, and A.3

With one or more cells in one 125 VDC subsystem and/or one 250 VDC subsystem < 2.07 V, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.1). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells < 2.07 V, and continued operation is permitted for a limited period up to 24 hours.

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

Since the Required Actions only specify "perform", a failure of SR 3.8.4.1 or 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Condition(s), depending on the cause of the failures, is entered. If SR 3.8.4.1 or 3.8.6.1 is failed then there is not assurance that there is still sufficient battery capacity to perform the intended function and the battery must be declared inoperable immediately.

B.1 and B.2

One or more batteries in one 125 VDC subsystem and/or one 250 VDC subsystem with float current > 2 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage. If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addressed charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to a temporary loss of the battery charger. A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 V and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

Since Required Action B.1 only specifies "perform," a failure of SR 3.8.4.1 acceptance criteria does not result in the Required Action not met. However, if SR 3.8.4.1 is failed, the appropriate Condition(s), depending on the cause of the failure, is entered.

C.1, C.2, and C.3

With one 125 VDC subsystem and/or one 250 VDC subsystem with one or more cells electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days the minimum established design limits for electrolyte level must be re-established.

(continued)

BASES

ACTIONS

C.1, C.2, and C.3 (continued)

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.13, Battery Monitoring and Maintenance Program). They are modified by a note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.13.b item to initiate action to equalize and test in accordance with manufacturer's recommendations are taken from Annex D of IEEE Standard 450-1995. They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cell(s) replaced.

D.1

With one 125 VDC subsystem and/or one 250 VDC subsystem with pilot cell temperature less than the minimum established design limits, 12 hours is allowed to restore the temperature to within limits. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

E.1

With one or more batteries in redundant trains with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function given that redundant batteries are involved. With redundant batteries involved, this potential could result in a total loss of function on multiple systems that rely upon the batteries. The longer completion times specified for battery parameters on non-redundant batteries not within limits are therefore not appropriate and the parameters must be restored to within limits on at least one train in each DC subsystem or division within 2 hours.

(continued)

BASES

ACTIONS (continued)

BF.1

When any battery parameter is outside the allowances of the Required Actions for Condition A, B, C, D, or E Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding battery DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, also are cause for immediately declaring the associated DC electrical power subsystem inoperable. discovering one or more batteries in one train with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately.

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

This SR verifies that Category A battery cell parameters are consistent with IEEE-450 (Ref. 4), which recommends regular battery inspections including voltage, specific gravity, and electrolyte temperature of pilot cells. The SR must be performed every 7 days, unless (as specified by the Note in the Frequency) the battery is on equalizing charge or has been on equalizing charge any time during the previous 4 days. This allows the routine 7-day Frequency to be extended until such a time that the SR can be properly performed and meaningful results obtained. The 14 day Frequency is not modified by the Note, thus regardless of how often the battery is placed on equalizing charge, the SR must be performed every 14 days.

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 4). The 7 day frequency is consistent with IEEE-450 (Ref. 4).

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1 (continued)

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained the Required Actions of LCO 3.8.4 ACTION A are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 2 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

SR 3.8.6.2 and SR 3.8.6.5

~~The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 4). In addition, within 24 hours of a battery discharge < 110 V for a 125 VDC battery and < 220 V for a 250 VDC battery or a battery overcharge > 150 V for a 125 VDC battery and > 300 V for a 250 VDC battery, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ 110 V for a 125 VDC battery and ≤ 220 V for a 250 VDC battery, do not constitute a battery discharge provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 4), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.~~

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 132 V for the 125 V batteries and 264 V for the 250 V batteries at the battery terminals, or 2.2 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self-discharge, which could eventually render the battery inoperable. Float voltage in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.13. SR's 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short-term absolute minimum cell voltage of 2.07 V. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 4).

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.3

This Surveillance verification that the average temperature of representative cells is within limits is consistent with a recommendation of IEEE-450 (Ref. 4) that states that the temperature of electrolytes in representative cells should be determined on a quarterly basis. The number of representative cells has been determined to be 10 cells for a 125 VDC battery and 20 cells for a 250 VDC battery.

Lower than normal temperatures act to inhibit or reduce battery capacity. This SR ensures that the operating temperatures remain within an acceptable operating range. This limit is based on manufacturer's recommendations.

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 4).

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e. 60°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 4).

SR 3.8.6.6

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test

The test is intended to determine overall battery degradation due to age and usage.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.~~3~~6 (continued)

A battery modified performance discharge test is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

The modified performance discharge test is a test of simulated duty cycle consisting of two different discharge rates. The first discharge rate consists of the one minute published rate for the battery or the largest current loads of the duty cycle followed by a second discharge rate which employs the test rate for the performance discharge test. These discharge rates envelop the duty cycle of the service test. Since the ampere-hours removed by a published one-minute discharge rate represent a very small portion of the battery capacity, the test rate can be changed to that for the performance discharge test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the service test.

When the battery loads after the first minute exceeds the performance test discharge rate, the modified performance discharge test is performed by first conducting the service test, than adjusting the discharge rate to the constant current value normally used for the performance discharge test. This test is terminated when the specified minimum battery terminal voltage is reached.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

When the battery loads after the first minute exceeds the performance discharge test rate, the battery capacity is calculated as follows:

% of rated capacity at 25°C (77°F) =

$$K\left[\frac{\sum (I_n)(t_n)}{Rated\ Ampere\ Hours}\right] x\, 100$$

Where:

K = Temperature Correction Factor from IEEE 450-1995

I_n = Discharge Current in amps for n-th section

T_n = Duration of n-th section discharge in hour

n = Section number for each portion of the discharge, including both service test and performance test portions

This % of rated capacity equation uses the temperature corrected Ampere-Hours instead of the temperature corrected discharge rates as specified in IEEE 450-1995. It is not possible to temperature correct the discharge rate without impacting the service test.

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 8) and IEEE-485 (Ref. 11). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

The Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected service life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity > 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 8), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 8).

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems.

~~Table 3.8.6-1~~

~~This table delineates the limits on electrolyte level, float voltage, and specific gravity for three different categories. The meaning of each category is discussed below.~~

~~Category A defines the normal parameter limit for each designated pilot cell in each battery. The cells selected as pilot cells are those whose temperature, voltage, and electrolyte specific gravity provide an indication of the state of charge of the entire battery.~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 4), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperature and charge effects. In addition to this allowance, footnote (a) to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 4) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendation of IEEE-450 (Ref. 4), which states that prolonged operation of cells below 2.13 V can reduce the life expectancy of cells. The Category A limit specified for specific gravity for each pilot cell is ≥ 1.200 (0.015 below the manufacturer's fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity.

According to IEEE-450 (Ref. 4), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

Category B defines the normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer's fully charged, nominal specific gravity) with the average of all connected cells 1.205 (0.010 below the manufacturer's fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell do not mask overall degradation of the battery.

Category C defines the limits for each connected cell. These values, although reduced, provide assurance that sufficient capacity exists to perform the intended function and maintain a margin of safety. When any battery parameter is outside the Category C limits, the assurance of sufficient capacity described above no longer exists, and the battery must be declared inoperable.

The Category C limit specified for electrolyte level (above the top of the plates and not overflowing) ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C allowable limit for voltage is based on IEEE-450 (Ref. 4), which states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

The Category C limit on average specific gravity ≥ 1.195, is based on manufacturer's recommendations (0.020 below the manufacturer's recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

The footnotes to Table 3.8.6-1 that apply to specific gravity are applicable to Category A, B, and C specific gravity. Footnote (b) of Table 3.8.6-1 requires the above mentioned correction for electrolyte temperature. A battery charging current of < 0.25 amp for Class 1E 250 V batteries and < 0.1 amp Class 1E 125 V batteries when on float charge is acceptable for meeting specific gravity limits because maintaining this current provides an indication that the state of change of the battery is acceptable.

Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. However, following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE-450 (Ref. 4). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity.

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).
4. IEEE Standard 450.
5. FSAR, Chapter 8.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources—Operating

BASES

BACKGROUND

The DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment. As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The Unit 2 DC power sources provide both motive and control power to selected safety related equipment, as well as circuit breaker control power for the nonsafety related 13.8 kV, 4.16 kV, and 480 V and lower AC distribution systems. Each DC subsystem is energized by one 125/250 V battery and at least 1 Class 1E battery charger. The 250 V DC batteries for division I are supported by two ~~half~~ full capacity chargers; the 250 V DC batteries for division II are supported by a full capacity charger; and, the 125 V DC batteries are each supported by a single full capacity charger. Each battery is exclusively associated with a single 125/250 VDC bus and cannot be interconnected with any other 125/250 VDC subsystem. The chargers are supplied from the same AC load groups for which the associated DC subsystem supplies the control power. Transfer switches provide the capability to power Unit 1 and common DC loads from Unit 2 DC sources.

Diesel Generator (DG) E DC power sources provide control and instrumentation power for DG E.

During normal operation, the DC loads are powered from the battery chargers with the batteries floating on the system. In case of loss of normal power to the battery charger, the DC loads are automatically powered from the station batteries.

The DC power distribution system is described in more detail in Bases for LCO 3.8.7, "Distribution System—Operating," and LCO 3.8.8, "Distribution System—Shutdown."

(continued)

BASES

BACKGROUND (continued)

Each battery has adequate storage capacity to carry the required load continuously for approximately 4 hours. to meet the duty cycle discussed in the FSAR, Chapter 8 (Ref. 12). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

Each subsystem, including the battery bank, chargers and DC switchgear, is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, or battery chargers.

The batteries for the electrical power subsystems are sized to produce required capacity at 80% of nameplate design rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 105/210 V. at the battery terminals.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit voltage of approximately 124 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage $\geq$ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage of 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.2 Vpc corresponds to a total float voltage output of 132 V for a 60 cell battery as discussed in the FSAR, Chapter 8 (Ref. 12).

Each battery charger of DC electrical power subsystem has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within design basis requirements while supplying normal steady state loads (Ref. 312).

(continued)

BASES

BACKGROUND (continued)

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger (if the discharge was significant, e.g. following a battery service test) until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6 (Ref. 4) and Chapter 15 (Ref. 5), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation. The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst case single failure.

The DC sources satisfy Criterion 3 of the NRC Policy Statement (Ref. 6).

(continued)

BASES (continued)

LCO

The DC electrical power subsystems are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 312).

The DC electrical power subsystems include:

a. each Unit 2 and Unit 1 DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt or 250 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus; and,

b. the Diesel Generator E DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, and 3 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 4 and 5 are addressed in the Bases for LCO 3.8.5, "DC Sources—Shutdown."

(continued)

BASES (continued)

ACTIONS

A.1, A.2, and A.3

Condition A represents one 125 VDC subsystem with one 125 VDC battery charger OR the 250 VDC subsystem battery charger inoperable OR two 250 VDC Division I subsystem battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharger event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery.

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 125 VDC temporary battery chargers shall have sufficient capacity to supply normal DC loads, and accident loads (other than 1st minute LOCA/LOOP loads), while maintaining the batteries operable. The 7 day completion time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

B.1

Condition B represents one 125 VDC battery bank or one 250 VDC battery bank that is inoperable. With one battery inoperable, the DC bus is being supplied by the OPERABLE battery charger. Any event that results in a loss of the AC bus supporting the battery chargers will also result in loss of DC to that 125 VDC or 250 VDC subsystem. Recovery of the AC bus, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed and diesel generator output circuit breakers, etc.) likely rely upon the battery. In addition the energization transients of any DC loads that are beyond the capability of the battery chargers and normally require the assistance of the battery will not be able to be brought online. The 2 hour limit allows sufficient time to effect restoration of an inoperable battery given that the majority of the conditions that lead to battery inoperability (e.g., loss of battery charger, battery cell voltage less than 2.07 V, etc.) are identified in Specifications 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

(continued)

BASES

ACTIONS (continued)

AC.1

Condition A C represents one subsystem with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. The 2 hour limit is consistent with the allowed time for an inoperable DC Distribution System division.

If one of the required DC electrical power subsystems is inoperable (e.g., for reasons other than Condition A or B ~~inoperable battery, inoperable battery charger(s), or~~ inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystems have the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the loss of minimum necessary DC electrical subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

Conditions A, B, and C are ~~is~~ modified by a Note that states that Conditions A, B, and C are ~~is~~ not applicable to the DG E DC electrical power subsystem. Conditions E ~~G~~ or ~~D~~ F ~~is~~ are applicable to an inoperable DG E DC electrical power subsystem.

~~B~~D.1 and ~~B.~~D2

If the inoperable Unit 2 DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 4 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7). .

(continued)

BASES

ACTIONS (continued)

CE.1

If Diesel Generator E is not aligned to the class 1E distribution system, the only supported safety function is for the ESW system. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or shutdown Diesel Generator E and close the associated ESW valves in order to ensure the OPERABILITY of the ESW system. The 2 hour limit is consistent with the allowed time for other inoperable DC sources and provides sufficient time to evaluate the condition of the battery and take the corrective actions.

DF.1

If the Diesel Generator is aligned to the class 1E distribution system, the loss of Diesel Generator E DC power subsystem will result in the loss of a on-site Class 1E power source. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or declare Diesel Generator E inoperable and take Actions of LCO 3.8.1. The 2 hour limit is consistent with the allowed time for other DC sources and provides sufficient time to evaluate the condition of the battery and take the necessary corrective actions.

EG.1 and EG.2

With one or more DC Unit 1 DC power subsystems inoperable, the remaining DC electrical power distribution subsystems are capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single failure. However, overall reliability is reduced because a single failure in the remaining DC electrical power distribution subsystems could result in the minimum required ESF functions not being supported. The Completion Time of 2 hours is consistent with the Completion Times associated with a loss of one or more DC distribution subsystems and will allow sufficient time to restore power.

(continued)

BASES

ACTIONS

~~E~~G.1 and ~~E~~G.2 (continued)

Completion of Required Action E.1 causes Unit 1 loads to be powered from a Unit 2 DC electrical power subsystem. Although the corresponding Unit 2 DC electrical power subsystems are evaluated for this condition, the CONDITION violates a design commitment to maintain DC power separation between units. To minimize the time this condition exists, Required Action E.2 directs power to be restored to the corresponding Unit 1 DC electrical power subsystem, which restores power to the common loads, or requires that the Unit 1 and common loads be declared inoperable. The Completion Time of 72 hours provides sufficient time to restore power and acknowledges the fact that the condition, although not consistent with all design requirements, maintains all required safety systems available.

~~F~~H.1

If Unit 1 and common loads required to support Unit 2 cannot be transferred to corresponding Unit 2 DC electrical power subsystem when Unit 1 DC sources are inoperable; or, cannot be transferred back to a Unit 1 DC source when the Unit 1 DC source becomes OPERABLE, the associated loads may be incapable of performing their intended function and must be declared inoperable immediately.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the battery chargers, which support the ability of the batteries to perform their intended function. ~~charging system and the ability of the batteries to perform their intended function.~~ -Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery ~~(or battery cell)~~ and maintain the battery ~~(or a battery cell)~~ in a fully charged state~~.~~ while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer (2.20 Vpc or 132 V at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). ~~The voltage requirements are consistent with the initial voltages assumed in the battery sizing calculations.~~ The SR must be performed every 7 days consistent with manufacturer recommendations and IEEE-450 (Ref. 8). ~~However, this Frequency is modified by a Note that allows the Frequency to be extended for up to 14 days when the battery is on equalize charge or has been on equalize charge any time during the previous 24 hours. This change recognizes the routine 7 day Frequency must be extended until 24 hours after an equalize charge is completed so that meaningful results are obtained for this SR. The 14 day Frequency is not modified by the Note, therefore, the SR must be performed every 14 days regardless of how often the battery is placed on equalize charge.~~

~~SR 3.8.4.2~~

~~Visual inspection to detect corrosion of the battery cells and connections; or, measurement of the resistance of each inter-cell, inter-rack, inter-tier, and terminal connection with visible corrosion, provides an indication that there is no physical damage or abnormal deterioration that could potentially degrade battery performance.~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.2 (continued)

The connection resistance limits established for this SR provide two acceptance limits for any connection where there is visible signs of corrosion. The first limit, if met, requires no additional actions and ensures the design capability of the battery is maintained. If the second limit is used, the calculated average resistance for the associated battery determined is SR 3.8.4.5 shall be recalculated using the new resistance value. Resistance valves shall be measured for only those connections where there is visible signs of corrosion. To determine the average connection resistance, data from the performance of SR 3.8.4.5 can be used for unaffected connections.

The Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.3

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not represent a failure of this SR, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function).

The Frequency of this SR is acceptable because other administrative controls ensure adequate battery performance during the 18 month interval. Furthermore, operating experience has shown these components usually pass the Surveillance when performed at the 18 month Frequency; therefore, the Frequency is acceptable from a reliability standpoint.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provides an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection.

The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR, provided visible corrosion is removed during performance of this Surveillance. The connection resistance limits for this SR must be below the limits specified in the SR. The calculated average resistance limits ensures that the total voltage drop across the battery connections is consistent to those assumed in the battery calculations, while the upper limit for battery resistance prevents the possibility of battery discharge due to overheating of the connections.

The Frequency of this SR is acceptable because other administrative controls ensure adequate battery performance during the 18 month interval. Furthermore, operating experience has shown these components usually pass the Surveillance when performed at the 18 month Frequency; therefore, the Frequency is acceptable from a reliability standpoint.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.62

Battery charger capability requirements are based on This SR verifies the design capacity of the battery chargers (Ref. 3). According to Regulatory Guide 1.32 (Ref. 9), the battery charger supply is required recommended to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying DC current to its associated battery bank at the minimum established float voltage for greater than or equal to 4 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

The other option requires that each battery charger be capable of recharging the battery bank after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 2 amps.

The Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 24 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.4.~~7~~3

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The test can be conducted using actual or simulated loads. The discharge rate and test length corresponds to the design duty cycle requirements as specified in Reference 12.

The Frequency of 24 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests not to exceed 24 months.

This SR is modified by ~~a~~ two Notes. Note 1 ~~which~~ allows only the performance of a modified performance discharge test SR 3.8.6.6 in lieu of a service test SR 3.8.4.3~~once per 60 months~~.

~~A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.~~

~~The modified performance discharge test is a test of simulated duty cycle consisting of two different discharge rates. The first discharge rate consists of the one minute published rate for the battery or the largest current loads of the duty cycle followed by a second discharge rate which employs the test rate for the performance discharge test. These discharge rates envelope the duty cycle of the service test. Since the ampere-hours removed by a published one minute discharge rate represent a very small portion of the battery capacity, the test rate can be changed to that for the performance discharge test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the service test.~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7 (continued)

When the battery loads after the first minute exceeds the performance test discharge rate, the modified performance discharge test is performed by first conducting the service test, then adjusting the discharge rate to the constant current value normally used for the performance discharge test. This test is terminated when the specified minimum battery terminal voltage is reached.

When the battery loads after the first minute exceeds the performance discharge test rate, the battery capacity is calculated as follows:

% of rated capacity at 25°C (77°F) =

$$K\left[\frac{\sum (I_n)(t_n)}{Rated\ Ampere\ Hours}\right] x\ 100$$

Where:

K = Temperature Correction Factor from IEEE 450-1995

I_n = Discharge Current in amps for n-th section

t_n = Duration of n-th section discharge in hour

n = Section number for each portion of the discharge, including both service test and performance test portions

This % of rated capacity equation uses the temperature corrected Ampere Hours instead of the temperature corrected discharge rates as specified in IEEE 450-1995. It is not possible to temperature correct the discharge rate without impacting the service test.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.7-3 (continued)

The SR is modified by a NoteThe reason for the Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems. Credit may be taken for unplanned events that satisfy the Surveillance. Examples of unplanned events may include:

1. Unexpected operational events which cause the equipment to perform the function specified by this Surveillance, for which adequate documentation is available; and

2. Post maintenance testing that requires performance of this Surveillance in order to restore the component to OPERABLE, provided the maintenance was required, or performed in conjunction with maintenance required to maintain OPERABILITY or reliability.

SR 3.8.4.8

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

A battery modified performance discharge test is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 8) and IEEE-485 (Ref. 11). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.8 (continued)

The Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected service life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 8), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 8).

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the Electrical Distribution System, and challenge safety systems.

SR 3.8.4.94

This Surveillance is provided to direct that Surveillances for the Unit 1 DC sources required to support Unit 2 are governed by the Unit 2 Technical Specifications. When Unit 1 DC Sources are required to be Operable to support Unit 2, the Unit 1 Surveillances must be met. Performance of a Unit 1 Surveillance at the specified Frequency will satisfy Unit 2 requirements.

When Unit 1 is in MODE 4 or 5 or moving irradiated fuel assemblies in the secondary containment, a Note to SR 3.8.5.1 specifies that some SRs are required to be met but do not have to be performed. The Note to Unit 2 SR 3.8.5.1 states that the Note to Unit 1 SR 3.8.2.1 is applicable if Unit 1 is in MODE 4 or 5. This ensures that Unit 2 Technical Specifications do not require a Unit 1 SR to be performed, when the Unit 1 Technical Specifications does not require performance of a Unit 1 SR.

(continued)

BASES (continued)

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6.
3. IEEE Standard 308.
4. FSAR, Chapter 6.
5. FSAR, Chapter 15.
6. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).
7. Regulatory Guide 1.93.
8. IEEE Standard 450.
9. Regulatory Guide 1.32, February 1977.
10. Regulatory Guide 1.129, April 1977, February 1978.
11. IEEE Standard 485~~, 1983~~.
12. FSAR Chapter 8, Section 8.3.2.1.1.6.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources—Shutdown

BASES

BACKGROUND

A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources—Operating."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum DC electrical power sources during MODES 4 and 5 and during movement of irradiated fuel assemblies ensures that:

a. The facility can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel handling accident.

LCO 3.8.5 is normally satisfied by maintaining the OPERABILITY of all Division I or all Division II DC sources listed in Table 3.8.4-1 and the Diesel Generator E battery bank. However, any combination of DC sources that maintain OPERABILITY of equipment required by Technical Specifications may be used to satisfy this LCO. The DC sources satisfy Criterion 3 of the NRC Policy Statement (Ref. 3).

(continued)

BASES (continued)

LCO

The DC electrical power subsystems are required to be OPERABLE as needed to support required DC distribution subsystems required OPERABLE by LCO 3.8.8, "Distribution Systems—Shutdown." This requirement ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents and inadvertent reactor vessel draindown).

The DC electrical power subsystems consist of the following:

a. each Unit 2 and Unit 1 DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt or 250 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus; and,

b. the Diesel Generator E DC electrical power subsystem identified in Table 3.8.4-1 including a 125 volt DC battery bank in parallel with a battery charger and the corresponding control equipment and interconnecting cabling supplying power to the associated bus.

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 4 and 5 and during movement of irradiated fuel assemblies in the secondary containment provide assurance that:

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;

b. Required features needed to mitigate a fuel handling accident are available;

c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The DC electrical power requirements for MODES 1, 2, and 3 are covered in LCO 3.8.4.

(continued)

BASES (continued)

ACTIONS

The ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. This is acceptable because LCO 3.0.3 would not specify any additional actions while in MODE 4 or 5 and moving irradiated fuel assemblies.

A.1, A.2, and A.3

Condition A represents one 125 VDC subsystem with one 125 VDC battery charger OR the 250 VDC Division II subsystem battery charger inoperable OR two 250 VDC Division I subsystem battery chargers inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period. Required Action A.1 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that within 12 hours, the battery will be restored to its fully charged condition (Required Action A.2) from any discharge that might have occurred due to the charger inoperability. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery.

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharger event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.2).

Required Action A.2 requires that the battery float current be verified as less than or equal to 2 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 2 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.3 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 125 VDC temporary battery chargers shall have sufficient capacity to supply normal DC loads, and accident loads (other than 1st minute LOCA/LOOP loads), while maintaining the batteries operable. The 7 day completion time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

(continued)

BASES

ACTIONS (continued)

AB.1, AB.2.1, AB.2.2, A-B2.3, and AB.2.4

If more than one Unit 2 DC distribution subsystem is required according to LCO 3.8.8, the remaining operable Unit 2 DC subsystems may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. Therefore, the option is provided to declare required features with associated DC power sources inoperable which ensures that appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS.

In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and any activities that could result in inadvertent draining of the reactor vessel). Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required Unit 2 DC electrical power subsystems and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the plant safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystems should be completed as quickly as possible in order to minimize the time during which the plant safety systems may be without sufficient power.

Conditions A and B are is modified by a Note that states that Conditions A and B are is not applicable to the DG E DC electrical power subsystem. Conditions B C and C D are applicable to an inoperable DG E DC electrical power subsystem.

(continued)

BASES

ACTIONS (continued)

~~B~~C.1

If Diesel Generator E is not aligned to the class 1E distribution system, the only supported safety function is for the ESW system. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE, to ensure the OPERABILITY of the ESW system, actions are taken to restore the battery to OPERABLE status. The 2 hour limit is consistent with the allowed time for other inoperable DC sources that result in a loss of safety function and provides sufficient time to evaluate the condition of the battery and take the corrective actions.

~~C~~D.1

If the Diesel Generator E is aligned to the class 1E distribution system, the loss of Diesel Generator E DC power subsystem will result in the loss of a on-site Class 1E power source. Therefore, under this condition, if Diesel Generator E DC power subsystem is not OPERABLE actions are taken to either restore the battery to OPERABLE status or declare Diesel Generator E inoperable and take Actions of LCO 3.8.2. The 2 hour limit is consistent with the allowed time for other DC sources that result in a loss of safety function and provides sufficient time to evaluate the condition of the battery and take the necessary corrective actions.

~~D~~E.1

The Unit 1 DC subsystems supporting Unit 2 that remain OPERABLE with one or more Unit 1 DC power sources inoperable may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. Therefore, the option is provided to declare required features with associated DC power sources inoperable which ensures that appropriate restrictions are implemented in accordance with the affected system LCOs' ACTIONS.

Condition D is modified by a Note that states that Condition D is not applicable to the DG E DC electrical power subsystem. Condition B or C is applicable to an inoperable DG E DC electrical power subsystem.

(continued)

BASES

ACTIONS (continued)

DE.2.1, DE.2.2, DE.2.3, and DE.2.4

In many instances, the option of declaring individual supported equipment inoperable may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, and any activities that could result in inadvertent draining of the reactor vessel). Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required Unit 1 DC electrical power subsystems and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the plant safety systems.

DE.3.1, DE.3.2.1, and DE.3.2.2

The option to transfer required common loads to an OPERABLE Unit 2 DC electrical power subsystem ensures required power will be restored. However, although the corresponding Unit 2 DC electrical power subsystems are evaluated for this condition, this violates a design commitment to maintain DC power separation between units. To minimize the time this condition exists, Required Action D.3.2 directs that power supply be restored to the corresponding Unit 1 DC electrical power subsystem, which restores power to the common loads, or requires that the Unit 1 and common loads are declared inoperable. The Completion Time of 72 hours provides sufficient time to restore power and acknowledges the fact that the condition, although not consistent with design requirements, maintains all required safety systems available.

DE.1, DE.2.1, DE.2.2, DE.2.3, DE.2.4, DE.3.1, DE.3.2.1, and DE.3.2.2

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystems should be completed as quickly as possible in order to minimize the time during which the plant safety systems may be without sufficient power.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.83. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

SR 3.8.5.2

This Surveillance is provided to direct that Surveillances for the Unit 1 DC sources required to support Unit 2 are governed by the Unit 2 Technical Specifications. When Unit 1 DC Sources are required to be Operable to support Unit 2, the Unit 1 Surveillances must be met. Performance of a Unit 1 Surveillance that satisfies Unit 1 requirements will satisfy Unit 2 requirements. Performance of Unit 1 Surveillances at the specified Frequency satisfies Unit 2 requirements.

When a Unit is in MODE 4 or 5, a Note to SR 3.8.5.1 specifies that some SRs are required to be met but do not have to be performed. The Note to Unit 2 SR 3.8.5.2 states that the Note to Unit 1 SR 3.8.2.1 is applicable if Unit 1 is in MODE 4 or 5. This ensures that a Unit 2 SR will not require a Unit 1 SR to be performed, when the Unit 1 Technical Specifications does not require performance of a Unit 1 SR.

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. *Final Policy Statement on Technical Specifications Improvements*, July 22, 1993 (58 FR 39132).

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery ~~Cell~~ Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage~~, and specific gravity~~ for the DC electrical power subsystems batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources— Operating," and LCO 3.8.5, "DC Sources—Shutdown." In addition to the limitations of this Specification, the Battery Monitoring and Maintenance Program also implements a program specified in Specification 5.5.13 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450-1995, IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref. 4).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 124 V for a 60 cell battery (i.e., cell voltage of 2.06 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.06 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage of 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.2 Vpc corresponds to a total float voltage output of 132 V for a 60 cell battery as discussed in the FSAR, Chapter 8 (Ref. 5).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)	The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources identified in Table 3.8.4-1 OPERABLE during accident conditions, in the event of: a. An assumed loss of all offsite AC or all onsite AC power; and b. A worst case single failure. Since battery ~~cell~~ parameters support the operation of the DC electrical power subsystems, they satisfy Criterion 3 of the NRC Policy Statement (Ref. 3).
LCO	Battery ~~cell~~ parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. ~~Electrolyte~~ Battery parameter limits are conservatively established, allowing continued DC electrical system function even with ~~Category A and B~~ limits not met. Additional preventative maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.13, Programs and Manuals.
APPLICABILITY	The battery ~~cell~~ parameters are required solely for the support of the associated DC electrical power subsystem. Therefore, battery ~~cell~~ parameters are required to be within required limits only when the associated DC power source is required to be OPERABLE. Refer to the Applicability discussions in Bases for LCO 3.8.4 and LCO 3.8.5.

(continued)

BASES (continued)

ACTIONS

A Note has been added to provide clarification that, for the purpose of this LCO, separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable battery. Complying with the Required Actions may allow for continued operation, and subsequent inoperable batteries are governed by subsequent Condition entry and application of associated Required Actions.

~~A.1, A.2, and A.3~~

~~With parameters of one or more cells in one or more batteries not within limits (i.e., Category A limits not met or Category B limits not met, or Category A and B limits not met) but within the Category C limits specified in Table 3.8.6-1, the battery is degraded but there is still sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of Category A or B limits not met, and continued operation is permitted for a limited period.~~

~~The pilot cell electrolyte level and float voltage are required to be verified to meet the Category C limits within 1 hour (Required Action A.1). This check provides a quick indication of the status of the remainder of the battery cells. One hour provides time to inspect the electrolyte level and to confirm the float voltage of the pilot cell. One hour is considered a reasonable amount of time to perform the required verification.~~

~~Verification that the Category C limits are met (Required Action A.2) provides assurance that during the time needed to restore the parameters to the Category A and B limits, the battery is still capable of performing its intended function. A period of 24 hours is allowed to complete the initial verification because specific gravity measurements must be obtained for each connected cell. Taking into consideration both the time required to perform the required verification and the assurance that the battery cell parameters are not severely degraded, this time is considered reasonable. The verification is repeated at 7 day intervals until the parameters are restored to Category A and B limits. This periodic verification is consistent with the normal Frequency of pilot cell Surveillances.~~

(continued)

BASES

ACTIONS

~~A.1, A.2, and A.3 (continued)~~

~~Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A and B limits. Taking into consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery cell parameters to normal limits, this time is acceptable for operation prior to declaring the DC batteries inoperable.~~

A.1, A.2, and A.3

With one or more cells in one 125 VDC subsystem and/or one 250 VDC subsystem < 2.07 V, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.1). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells < 2.07 V, and continued operation is permitted for a limited period up to 24 hours.

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Condition(s), depending on the cause of the failures, is entered. If SR 3.8.4.1 or 3.8.6.1 is failed then there is not assurance that there is still sufficient battery capacity to perform the intended function and the battery must be declared inoperable immediately.

B.1 and B.2

One or more batteries in one 125 VDC subsystem and/or one 250 VDC subsystem with float current > 2 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addressed charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 V, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 V there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to a temporary loss of the battery charger. A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 V and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

Since Required Action B.1 only specifies "perform," a failure of SR 3.8.4.1 acceptance criteria does not result in the Required Action not met. However, if SR 3.8.4.1 is failed, the appropriate Condition(s), depending on the cause of the failure, is entered.

(continued)

BASES

ACTIONS (continued)

C.1, C.2, and C.3

With one 125 VDC subsystem and/or one 250 VDC subsystem with one or more cells electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days the minimum established design limits for electrolyte level must be re-established.

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.13, Battery Monitoring and Maintenance Program). They are modified by a note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.13.b item to initiate action to equalize and test in accordance with manufacturer's recommendations are taken from Annex D of IEEE Standard 450-1995. They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cell(s) replaced.

D.1

With one 125 VDC subsystem and/or one 250 VDC subsystem with pilot cell temperature less than the minimum established design limits, 12 hours is allowed to restore the temperature to within limits. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

(continued)

BASES

ACTIONS (continued)

E.1

With one or more batteries in redundant trains with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function given that redundant batteries are involved. With redundant batteries involved, this potential could result in a total loss of function on multiple systems that rely upon the batteries. The longer completion times specified for battery parameters on non-redundant batteries not within limits are therefore not appropriate and the parameters must be restored to within limits on at least one train in each DC Subsystem or Division within 2 hours.

BF.1

When any battery parameter is outside the allowances of the Required Actions for Condition A, B, C, D, or E Category C limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding battery DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F, also are cause for immediately declaring the associated DC electrical power subsystem inoperable. discovering one or more batteries in one train with one or more battery cells float voltage less than 2.07 V and float current greater than 2 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

~~This SR verifies that Category A battery cell parameters are consistent with IEEE-450 (Ref. 4), which recommends regular battery inspections including voltage, specific gravity, and electrolyte temperature of pilot cells. The SR must be performed every 7 days, unless (as specified by the Note in the Frequency) the battery is on equalizing charge or has been on equalizing charge any time during the previous 4 days. This allows the routine 7-day Frequency to be extended until such a time that the SR can be properly performed and meaningful results obtained. The 14-day Frequency is not modified by the Note, thus regardless of how often the battery is placed on equalizing charge, the SR must be performed every 14 days.~~

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 4). The 7 day frequency is consistent with IEEE-450 (Ref. 4).

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained the Required Actions of LCO 3.8.4 ACTION A are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 2 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.2 and SR 3.8.6.5

~~The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 4). In addition, within 24 hours of a battery discharge < 110 V for a 125 VDC battery and < 220 V for a 250 VDC battery or a battery overcharge > 150 V for a 125 VDC battery and > 300 V for a 250 VDC battery, the battery must be demonstrated to meet Category B limits. Transients, such as motor starting transients, which may momentarily cause battery voltage to drop to ≤ 110 V for a 125 VDC battery and ≤ 220 V for a 250 VDC battery, do not constitute a battery discharge provided the battery terminal voltage and float current return to pre-transient values. This inspection is also consistent with IEEE-450 (Ref. 4), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurs as a consequence of such discharge or overcharge.~~

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 132 V for the 125 V batteries and 264 V for the 250 V batteries at the battery terminals, or 2.2 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltage in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.13. SR's 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum cell voltage of 2.07 V. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 4)

SR 3.8.6.3

~~This Surveillance verification that the average temperature of representative cells is within limits is consistent with a recommendation of IEEE-450 (Ref. 4) that states that the temperature of electrolytes in representative cells should be determined on a quarterly basis. The number of representative cells has been determined to be 10 cells for a 125 VDC battery and 20 cells for a 250 VDC battery.~~

~~Lower than normal temperatures act to inhibit or reduce battery capacity. This SR ensures that the operating temperatures remain within an acceptable operating range. This limit is based on manufacturer's recommendations.~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.3 (continued)

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 4).

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e. 60°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 4).

SR 3.8.6.6

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test.

The test is intended to determine overall battery degradation due to age and usage.

A battery modified performance discharge test is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8; however, only the modified performance discharge test may be used to satisfy SR 3.8.4.8 while satisfying the requirements of SR 3.8.4.7 at the same time.

A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

The modified performance discharge test is a test of simulated duty cycle consisting of two different discharge rates. The first discharge rate consists of the one minute published rate for the battery or the largest current loads of the duty cycle followed by a second discharge rate which employs the test rate for the performance discharge test. These discharge rates envelope the duty cycle of the service test. Since the ampere-hours removed by a published one minute discharge rate represent a very small portion of the battery capacity, the test rate can be changed to that for the performance discharge test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the service test.

When the battery loads after the first minute exceeds the performance test discharge rate, the modified performance discharge test is performed by first conducting the service test, than adjusting the discharge rate to the constant current value normally used for the performance discharge test. This test is terminated when the specified minimum battery terminal voltage is reached.

When the battery loads after the first minute exceeds the performance discharge test rate, the battery capacity is calculated as follows:

% of rated capacity at 25°C (77°F) =

$$K\left[\frac{\sum (I_n)(t_n)}{Rated\ Ampere\ Hours}\right] x\,100$$

Where:

K = Temperature Correction Factor from IEEE 450-1995

I_n = Discharge Current in amps for n-th section

T_n = Duration of n-th section discharge in hour

n = Section number for each portion of the discharge, including both service test and performance test portions

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.6 (continued)

This % of rated capacity equation uses the temperature corrected Ampere-Hours instead of the temperature corrected discharge rates as specified in IEEE 450-1995. It is not possible to temperature correct the discharge rate without impacting the service test.

The acceptance criteria for this Surveillance is consistent with IEEE-450 (Ref. 8) and IEEE-485 (Ref. 11). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected service life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected service life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity > 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 8), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 10% below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 8).

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems.

~~Table 3.8.6-1~~

~~This table delineates the limits on electrolyte level, float voltage, and specific gravity for three different categories. The meaning of each category is discussed below.~~

~~Category A defines the normal parameter limit for each designated pilot cell in each battery. The cells selected as pilot cells are those whose temperature, voltage, and electrolyte specific gravity provide an indication of the state of charge of the entire battery.~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

Table 3.8.6-1 (continued)

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 4), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperature and charge effects. In addition to this allowance, footnote a to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 4) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendation of IEEE-450 (Ref. 4), which states that prolonged operation of cells below 2.13 V can reduce the life expectancy of cells. The Category A limit specified for specific gravity for each pilot cell is ≥ 1.200 (0.015 below the manufacturer's fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity.

According to IEEE-450 (Ref. 4), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell increases with a loss of water due to electrolysis or evaporation.

Category B defines the normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

(continued)

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Table 3.8.6-1 (continued)

The Category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer's fully charged, nominal specific gravity) with the average of all connected cells 1.205 (0.010 below the manufacturer's fully charged, nominal specific gravity). These values are based on manufacturer's recommendations. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell do not mask overall degradation of the battery.

Category C defines the limits for each connected cell. These values, although reduced, provide assurance that sufficient capacity exists to perform the intended function and maintain a margin of safety. When any battery parameter is outside the Category C limits, the assurance of sufficient capacity described above no longer exists, and the battery must be declared inoperable.

The Category C limit specified for electrolyte level (above the top of the plates and not overflowing) ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C allowable limit for voltage is based on IEEE-450 (Ref. 4), which states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

The Category C limit on average specific gravity ≥ 1.195, is based on manufacturer's recommendations (0.020 below the manufacturer's recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell does not mask overall degradation of the battery.

(continued)

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~~Table 3.8.6-1 (continued)~~

~~The footnotes to Table 3.8.6-1 that apply to specific gravity are applicable to Category A, B, and C specific gravity. Footnote (b) of Table 3.8.6-1 requires the above mentioned correction for electrolyte temperature. A battery charging current of < 0.25 amp for Class 1E 250 V batteries and < 0.1 amp Class 1E 125 V batteries when on float charge is acceptable for meeting specific gravity limits because maintaining this current provides an indication that the state of change of the battery is acceptable.~~

~~Because of specific gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. However, following a minor battery recharge (such as equalizing charge that does not follow a deep discharge) specific gravity gradients are not significant. A stabilized charger current is an acceptable alternative to specific gravity measurement for determining the state of charge. This phenomenon is discussed in IEEE 450 (Ref. 4). Footnote (c) to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity.~~

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 15.
3. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).
4. IEEE Standard 450.
5. FSAR, Chapter 8.